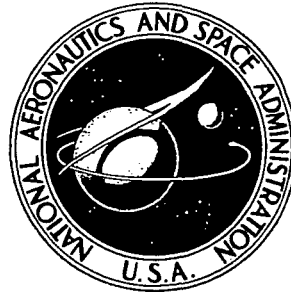


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**SPACE APPLICATIONS  
INSTRUMENTATION SYSTEMS**

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## SPACE APPLICATIONS INSTRUMENTATION SYSTEMS

By R. A. Minzner and J. D. Oberholtzer  
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### SUMMARY

A compendium of resumes of 158 instrument systems or experiments, of particular interest to space applications, is presented. Each resume exists in a standardized format, permitting entries for 26 administrative items and 39 scientific or engineering items. A Table of Contents shows that resumes are organized into forty groups determined by the forty spacecraft with which the instruments are associated. The resumes are followed by six different cross indexes; each organized alphabetically according to one of the following categories: Instrument Name, Acronym, Name of Principal Investigator, Name of Organization Employing the Principal Investigator, Assigned Experiment Number, and Spacecraft Name. The resumes are associated with a computerized Instrument Resume Search and Retrieval System (IRSARS).

### INTRODUCTION

This document presents an interim report on Project 160-44-02-28-25, the objective of which has been to maintain an up-to-date survey of instrument systems of particular interest in space applications, and primarily intended for unmanned spacecraft. The continuing objective has been realized to date by the preparation of this compendium of standardized resumes for 158 specific systems. The systems described range from instruments (or experiments) which have already flown in orbiting spacecraft, to proposals for development projects. Each principal investigator, except any associated with instruments in the GEOS and ERTS satellites, and any recently appointed, has had the opportunity of reviewing some version of all resumes in which he is named. The set of resumes is preceded by an extensive Table of Contents; the resumes are followed by six different indexes.

The set of resumes is divided into two major groups. The first group, Part I, contains resumes describing instruments (or experiments) which have been built and flown, or are being built and tested for specifically planned flights. This group includes the resumes of about 100 space applications instruments (or experiments) associated with approximately forty spacecraft. The group includes separate resumes for each of a number of nominally similar instruments in each of several spacecraft. Such apparent duplication is necessary because successive models of essentially the same

instrument for different spacecraft are rarely alike. (An example of an instrument that has several models is the Satellite Infrared Radiometer Spectrometer, SIRS, which is aboard Nimbus 3, and scheduled to fly on Nimbus D.)

The second major group, Part II, contains those resumes for instruments (or experiments) which have been proposed but which have not been scheduled for flight in specific spacecraft, and for which production funds were not or have not yet been granted. The application instruments and experiments which were originally proposed for the Apollo program are included in this group. In a few instances, for proprietary reasons, the principal investigator has not released for general publication a resume listed in the Table of Contents and Indexes. In these cases, the indexing information has been retained for completeness, but the resume has been deleted so that the distribution of this document need not be limited.

Each resume is printed as a single page, and is a photographically reduced version of an original which was printed by a computer output device onto a special form. The form allows for sixty-five printed entries (ref. 1), and represents a slight modification of an earlier form having sixty-eight printed entries (ref. 2). The information for each item in a resume, in accordance with its own specific format (ref. 2) had been entered into a computer input and storage system previously. A computer program named IRSARS (ref. 2 and 3) permits a search to be made within the stored information for those instruments having characteristics which comply with specific limits of conditions of any of thirty-seven of the entries. The selected resumes or part thereof may be printed by the computer output device. No provisions have been made in IRSARS for either computer storage or computer print-out of the diagrams called for in Item 66. Suitable diagrams have been collected for some of these resumes, but no attempt has been made to include any figures in this edition of the compendium.

The Table of Contents preceding the two groups of resumes, and the six indexes which follow the resumes have some intrinsic interest. The Table of Contents shows that resumes have been organized into a number of sections named after the forty associated spacecraft; these section names serve as an alphabetical index of these spacecraft. (A separate spacecraft listing is given in Index 6.) The names of the associated instruments (or experiments) are arranged alphabetically under each section name. Entries for similar instruments are each found under the appropriate spacecraft-section name rather than being grouped together. Thus, for example, the Satellite Infrared Radiometer Spectrometer, SIRS, can be found listed under Nimbus 3 as well as under Nimbus D; the Filter Wedge Spectrometer (FWS) can be found listed under Nimbus D in the first group of resumes, as well as under Apollo

Applications in the proposal group. In addition to the instrument name, each entry of any section of the Table of Contents also includes an acronym (or an abbreviation for the instrument of experiment name), any experiment numbers assigned by NASA Headquarters, and the name of the principal investigator for that instrument (or experiment).

The six indexes following the resumes also have been prepared with auxiliary material.

The first index is basically an alphabetical listing of the instrument (or experiment) names of the entire set of resumes (in contrast to the Table of Contents where the alphabetical listing was within sections separated according to spacecraft). Otherwise this index has the same information as that contained in the Table of Contents.

The second index is an alphabetically-arranged list of the names of the principal investigators. Each entry of this index also contains the organizational affiliation of the principal investigator, the acronym, the name of the spacecraft to which the instrument is assigned and, finally, any Headquarters-assigned experiment number.

The third index is an alphabetically-arranged list of the acronyms for the instrument (or experiment) name. Each entry of this index also contains the name of the spacecraft with which the system is identified, any assigned experiment number, the name of the associated principal investigator and, finally, the name of the instrument (or experiment).

The fourth index is an alphabetically-arranged list of the names of organizations by which each of the respective principal investigators is employed. Each entry of this index also includes the name of the principal investigator, the acronym, and the name of the associated spacecraft.

The fifth index is organized alphabetically and numerically according to a Headquarters-assigned experiment number. For example, the designation E01 was given to the Limb Radiance Experiment proposal for the Nimbus E satellite, and S040 was assigned to the proposal for the Dielectric Tape Camera System for an Apollo Applications spacecraft. Since only a few instruments have been assigned these numbers, this is a relatively small index.

The sixth and final index is a simple alphabetical listing of spacecraft relevant to this document. The page number indicates the location of the beginning of the group of resumes describing the instrument systems associated with each of these spacecraft.

The information contained in this survey is believed to be accurate to January 1970. The future responsibility for the continuing work in this study will be assumed by: R. Drummond of Goddard Space Flight Center, Code 731, Greenbelt, Md., Telephone: 301/982-6731. Corrections and suggestions for improving the resumes should be sent to Mr. Drummond.

The authors wish to acknowledge the support of this work by Jules Lehmann in the Office of Space Science and Applications at NASA Headquarters, and would like to thank the staff at the IIT Research Institute who contributed to this volume, particularly, William Vest, Jerrold Miller, and Peter Bock.

#### REFERENCES

- (1) Miller, S., and Katz, N.: Addendum to Instrument Resumes for Space Applications, Employing a Computerized Search and Retrieval System. Final Report on Contract NAS 12-666, IIT Research Institute, 1970.
- (2) Bock, P., and Vest, W. L.: Instrument Resumes for Space Applications, Employing a Computerized Search and Retrieval System. Interim Report on Contract NAS 12-666, IIT Research Institute, 1969.
- (3) Bock, P., and Vest, W. L.: Operating manual for IRSARS (Instrument Resume Search and Retrieval System). Interim Report on Contract NAS 12-666, IIT Research Institute 1969.



PART 1

APOLLO 9

INSTRUMENT RESUME		NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS	
1. TITLE	MULTISPECTRAL TERRAIN-PHOTOGRAPHY EXPERIMENT		
(TITLE CONT.)			
2. ACRONYM	3. ENVAC		
4. RESOUR	MTP	S065	
5. DATE	11/10/69 0003		
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	
LOWMAN, DR. P.D.	GODDARD SPACE FLT CENTER	301-982-5554	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
COLWELL, DR. R.M.	UNIV OF CALIF, BERKELEY	415-845-6000-X1351	
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. DATE	
		15. DATE	
16. MONITOR	17. AGENCY	18. FOUR OFFICE TELEPHONE	
TERWILLIGER, R.G.	NASA HQDTRS	1055A/SRB 202-962-0574	
22. VENDOR	23. LOCATION	24. FLIGHT	
		25. DATE	
26. INSTRUMENT TYPE	HSC INHOUSE (HASSELBLAD) HOUSTON, TEXAS 03/69 NA		
28. APPLICATION	IMAGER, FOUR 70-MM MODEL 500-EL HASSELBLAD CAMERAS		
29. SPACECRAFT	APOLLO 9		
30. PURPOSE	PRIMARY- TO OBTAIN PHOTOGRAPHS, TAKEN SIMULTANEOUSLY, IN FOUR SPECIFIC PORTIONS OF THE VISIBLE AND NEAR (PHOTOGRAPHIC) INFRARED FOR EARTH RESOURCES APPLICATIONS. ***SECONDARY- TO ASSIST IN DETERMINING THE OPTIMUM FILM-FILTER COMBINATIONS FOR THE EARTH RESOURCES PROGRAM.		
31. PRINCIPLES OF OPERATION	<p>THE EQUIPMENT USED CONSISTS OF FOUR HASSELBLAD, 70 MM CAMERAS, MODEL 500-EL. THE INDIVIDUAL CAMERAS ARE SIMILAR TO THE 500 C USED ON PREVIOUS MANNED MISSIONS, EXCEPT THAT THIS SET IS ELECTRICALLY DRIVEN. THE CAMERAS ARE INSTALLED IN A COMMON MOUNT AND SYNCHRONIZED FOR SIMULTANEOUS EXPOSURE. THE MOUNT IS INSTALLED IN THE COMMAND MODULE HATCH WINDOW DURING PHOTOGRAPHIC OPERATIONS AND THE SPACECRAFT WILL BE ORIENTED TO PROVIDE VERTICAL PHOTOGRAPHY. AN INTERVALOMETER IS USED TO OBTAIN SYSTEMATIC OVERLAPPING (STEREO) PHOTOGRAPHY. POWER IS SUPPLIED BY INTERNAL BATTERIES. EACH CAMERA HAS A STANDARD 80 MM FOCAL LENGTH, PLANAR LENS AND A SINGLE FILM MAGAZINE CONTAINING FROM 160 TO 200 FRAMES. THE FOLLOWING FILM/FILTER COMBINATIONS WERE USED:</p> <p>1) INFRARED AEROPHOTOGRAPHIC FILM WITH AN 89B FILTER, 0.7 TO 0.9 MICRON; 2) COLOR IR WITH A WRATTEN 15 FILTER, 0.7 TO 0.9 MICRON; 3) PANATOMIC-X WITH A 25A FILTER, 0.58 MICRON INTO THE IR REGION; AND 4) PANATOMIC-X WITH A 58 FILTER, 0.48 TO 0.62 MICRON; PHOTOGRAPHIC COVERAGE OF THE SOUTHWEST U.S.A. WAS EMPHASIZED BECAUSE GROUND INFORMATION IS MORE AVAILABLE FOR THIS REGION THAN OTHER REGIONS.</p>		
32. PHENOMENA OBSERVED	REFLECTED SOLAR RADIATION FROM THE SURFACE OF THE EARTH		
33. MEASUREMENT RANGE	VARIES WITH TYPE OF FILM USED		
34. PRECISION AND ACCURACY			

0.48	TO	0.9	MICRON
52.0	BY	52.0	DEG 300 NM BY 300 NM FROM 300 NM ALTITUDE
0.009	DEG	280 FEET	FROM 300 NM ALTITUDE
5.0	DEG	LOW	CIRCULAR MEDIUM POSTGRADE
ORBITAL POSITION DATA IS DESIRED AT THE TIME OF EACH EXPOSURE			
4. HASSELBLAD CAMERAS			
28 LB	1.5	CU FT	
NONE	NONE	NONE	SENSITIVE
PRE- AND POSTFLIGHT ONLY MANNED RETURN AS PROGRAMMED			
NO SPECIFIC REQUIREMENTS			
NO GROUND SUPPORT REQUIRED, CAMERAS HAVE BEEN FLIGHT QUALIFIED			
1) EXPERIMENT IMPLEMENTATION PLAN FOR MULTISPECTRAL TERRAIN PHOTOGRAPHY (S065). NASA, SEPT 23, 1968.***2) NASA PRESS RELEASE NO:69-29, APOLLO 9. FEB 23, 1969.***3) VERNER, S.S.: OPTICAL IMAGERS FOR THE SMALL EARTH RESOURCES SATELLITE. IIT RESEARCH INSTITUTE, APRIL 1967.			
SIMILAR CAMERAS FLOWN ON OTHER MANNED FLIGHTS			

ATS 1

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
<b>FLUXGATE MAGNETOMETER</b>									
(TITLE CONT.)	4. RESUME DATE		5. VENDOR						
	11/10/69		0003						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
<b>COLEMAN, DR. P.J.</b>	<b>UNIV OF CALIF AT L.A.</b>								
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
	<b>NASS-9570</b>			<b>12/66</b>	<b>OPERATIONAL</b>				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
<b>BURKE, J.R.</b>	<b>NASA</b>	<b>HDOTRS</b>	<b>OSSA/SCS 202-962-0581</b>						
22. VENDOR	23. LOCATION	24. LEAD TIME							
<b>MARSHALL LABORATORIES</b>	<b>TORRANCE, CALIFORNIA</b>	<b>12/66</b>	<b>NMA</b>						
25. INSTRUMENT TYPE									
<b>MAGNETOMETER, BIAXIAL CLOSED LOOP FLUXGATE</b>									
26. APPLICATION	27. SPACECRAFT								
<b>ATM-PHYS</b>	<b>ATS 1</b>								
28. PURPOSE									
<b>PRIMARY - TO MEASURE THE MAGNETIC FIELD SURROUNDING THE SPACECRAFT, BOTH PARALLEL AND PERPENDICULAR TO THE SPIN AXIS AND TO DETECT MAGNETO HYDRO DYNAMIC (MHD) WAVE PROPAGATION WITHIN THE MAGNETOSPHERE.</b>									
<b>31. PRINCIPLES OF OPERATION</b> THIS INSTRUMENT IS SIMILAR TO THAT FLOWN ON OGO-E AND CONSISTS OF TWO CLOSED LOOP, HARMONIC FLUXGATE MAGNETOMETERS AND ASSOCIATED ELECTRONICS. THE AXES OF THE 2 MAGNETIC PROBES ARE 90 DEG TO EACH OTHER AND 45 DEG TO THE SPIN AXIS OF THE SPACECRAFT. EACH MAGNETOMETER OUTPUT IS A COMPOSITE VOLTAGE CONSISTING OF A DC VOLTAGE PROPORTIONAL TO THE AMBIENT FIELD PARALLEL TO THE SPIN AXIS AND A SINUSOIDAL VOLTAGE WITH PEAK AMPLITUDE PROPORTIONAL TO THE MAGNETIC FIELD PERPENDICULAR TO THE SPIN AXIS. BOTH OUTPUTS ARE FED INTO A DIFFERENTIAL AMPLIFIER AND A SUMMING AMPLIFIER. THE DIFFERENTIAL AMPLIFIER YIELDS A SINUSOIDAL SIGNAL PROPORTIONAL TO THE SUM OF THE AMPLITUDES OF THE TWO INPUT SINUSOIDS. THE OUTPUT OF THE SUMMING AMPLIFIER IS PROPORTIONAL TO THE SUM OF THE 2 DC COMPONENTS. THE INSTRUMENT HAS A SENSITIVITY OF 0.05 V PER GAMMA WHERE GAMMA EQUALS 10 TO THE MINUS 5 GAUSS. THE DYNAMIC RANGE IS +50, 100, OR 200 GAMMA. WITH THE USE OF AN OFFSET FIELD GENERATOR, THE TOTAL DYNAMIC RANGE IS INCREASED TO + 925 GAMMA AND - 675 GAMMA. THE INSTRUMENT ACCURACY IS +/- 0.125 GAMMA WITH A NOISE LEVEL OF 0.1 GAMMA. THE BASIC MAGNETOMETER RESPONSE BANDWIDTH IS FROM DC TO 100 HZ. IT PRODUCES AN OUTPUT VOLTAGE OF 0 TO + 5.0 VDC.									
32. PHENOMENA OBSERVED									
<b>MAGNETIC FIELD</b>									
33. MEASUREMENT RANGE									
<b>-125 TO +350 GAMMA PARALLEL AND -50 TO+50 GAMMA PERP TO S/C AXIS</b>									
34. PRECISION AND ACCURACY									
<b>SEE ITEM 31</b>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
<b>SEE ITEM 31</b>		
38. FIELD OF VIEW	39. GROUND SWATH	
<b>NA</b>	<b>NA</b>	
40. ANGULAR RESOLUTION (1/2 DEGREE)	41. PERIOD/SCAN	
<b>NA</b>	<b>NA</b>	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
<b>NA</b>	<b>NA</b>	<b>NA</b>
45. SYNCH CIRCULAR EQUATORIAL POSIGRADE		
46. SPECIAL REQUIREMENTS		
<b>SENSOR, ELECTRONICS</b>		
47. COMPONENTS		
<b>2 MAGNETOMETERS, DIFFERENTIAL AMPLIFIER, SUMMING AMPLIFIER</b>		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
<b>4 LB.</b>	<b>0.2 CU FT</b>	<b>0 WATTS</b>
51. INTERFERENCE	52. INTERFERENCE	53. INTERFERENCE
<b>NA</b>	<b>NA</b>	<b>NA</b>
54. CALIBRATION	55. DATA RECOVERY	56. REMOTE MOUNTING ON BOOM
<b>SENS</b>	<b>REALTIME TELEMETRY</b>	<b>CONTINUOUSLY</b>
57. TELEMETRY RATE		
<b>NA</b>		
58. ADVANTAGES AND LIMITATIONS		
59. REFERENCES		
<b>1) PARRY, J.D. AND SNARE, R.C.: A FLUXGATE MAGNETOMETER FOR THE APPLICATIONS TECHNOLOGY SATELLITE, FREE TRANSACTIONS ON NUCLEAR SCIENCE VOL. NS-13, NO. 6 DEC 1966 P 326-332. ***2) TECHNICAL DATA REPORT FOR THE ATS PROGRAM, GSFC VOL 6, 1968.</b>		
60. HISTORICAL REMARKS		

INSTRUMENT RESUME		NATIONAL Aeronautics and Space Administration Electronic Research Center Washington, DC 20546	
1. TITLE	MICROWAVE TRANSPONDER		
2. TITLE CONT.	[TITLE CONT.]		
3. PRINCIPAL INVESTIGATOR	DARCEY, R. J.		
4. CO-INVESTIGATOR	GODDARD SPACE FLT CENTER 301-982-4094		
5. CO-INVESTIGATOR	[CO-INVESTIGATOR]		
6. CONTRACT NUMBER	12/66 OPERATIONAL		
7. CONTRACT NUMBER	12/66 OPERATIONAL		
8. MONITOR	BURKE, J. R.		
9. MONITOR	NASA HQTRS. OSSA/SCS 202-962-0581		
10. VENDOR	HUGHES AIRCRAFT CO.		
11. VENDOR	EL SEGUNDO, CALIFORNIA 12/66 NA		
12. INSTRUMENT TYPE	TRANSPONDER, 6-GHZ (RECEIVE) 4-GHZ (TRANSMIT) SHF		
13. APPLICATION	ATS-1		
14. PURPOSE	PRIMARY- TO INVESTIGATE THE TRANSMISSION OF VOICE, TELEVISION, AND DIGITAL DATA USING SSB TRANSMITTER AND RECEIVER IN MULTIPLE ACCESS MODE AND A HIGH QUALITY FM SYSTEM FOR TELEVISION AND HIGH SPEED DATA RELAY. **SECONDARY- TO SHARE EFFICIENTLY THE SPACE-CRAFT TRANSMITTED SIGNAL INDEPENDENT OF THE NUMBER OF CHANNELS IN USE.		
15. PRINCIPLES OF OPERATION	THIS INSTRUMENT IS SIMILAR TO THOSE USED ON ATS-2 AND ATS-3. RECEIVING AND TRANSMITTING ANTENNAS AND TRAVELING-WAVE-TUBE POWER AMPLIFIERS ARE USED IN CONJUNCTION WITH A DUAL-MODE COMMUNICATION TRANSPONDER TO PROVIDE A SYSTEM ELEMENT CAPABLE OF ACCEPTING AND HANDLING ANY TYPE OF COMMUNICATIONS TRAFFIC OR WIDEBAND COMMUNICATIONS. THE FREQUENCY TRANSLATION MODE IS DESIGNED PRIMARILY FOR TELEVISION OR OTHER WIDEBAND USAGE IN WHICH ONE GROUND TRANSMITTER UTILIZES THE COMPLETE CHANNEL. THE USABLE BANDWIDTH IS 25 MHZ. THE MULTIPLE ACCESS MODE IS DESIGNED TO PERMIT THE INTERCONNECTION OF A LARGE NUMBER OF GROUND STATIONS IN A HIGH CHANNEL CAPACITY FREQUENCY DIVISION MULTIPLEX SYSTEM. FREQUENCY DIVISION MULTIPLEXING OF THE VOICE CHANNELS WITH SSB IS USED FOR THE VARIOUS GROUND-TO-SPACECRAFT LINKS. THESE SIGNALS ARE CONVERTED INTO PHASE MODULATION OF A SINGLE CARRIER IN THE SPACECRAFT AND ARE RETRANSMITTED TO ALL STATIONS IN THIS FORM. EACH GROUND STATION SELECTS THE APPROPRIATE CHANNELS FROM THE RECOVERED BASEBAND CONTAINING ALL CHANNELS TO COMPLETE THE TWO-WAY INTERCONNECTIONS. THE ANTENNA USED IS AN ELECTRICALLY DESPUN PHASED ARRAY. THE EFFECTIVE RADIATED POWER IS 166 WATTS.		
16. PHENOMENA OBSERVED	TRANSMISSIONS FROM ATS GROUND STATIONS AT 6 GHZ		
17. MEASUREMENT RANGE	[MEASUREMENT RANGE]		
18. PRECISION AND ACCURACY	[PRECISION AND ACCURACY]		

19. SPECTRAL RESOLUTION	12. TIME CONSTANT
6.212 TO 6.301 GHZ	25. MHZ
18.0 BY 23.0 DEG LIMB-TO-LIMB 9100 NM FROM GEO-SYNCH ALT	
20. POINTING RATE	24. ALTITUDE
21. POINTING RATE	25. INCLINATION
22. POINTING RATE	26. INCLINATION
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359. POINTING RATE	363. INCLINATION

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
SPIN-SCAN CLOUD-COVER CAMERA			SSCC						
(TITLE CONT.)			DATE						
MONOCHROMATIC			11/10/69 0003						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SUOMI, DR. V. E.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
PARENT, DR. R. J.	UNIVERSITY OF WISCONSIN	608-262-5939							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. STATUS							
NAS5-9677		2/66 OPERATIONAL							
18. MONITOR	19. AGENCY	20. PGMA OFFICE	21. TELEPHONE						
BURKE, J. R.	NASA HQTRS	OSMA/SCS	202-962-0581						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
SANTA BARBARA RES CTR	GOLETA, CALIFORNIA	12/66 NA							
26. INSTRUMENT TYPE									
IMAGER, TELESCOPE-PHOTOMULTIPLIER ONE-CHANNEL VISIBLE									
28. APPLICATION	29. SPACECRAFT								
NET	ATS 1								
30. PURPOSE	UNC.								
<p>31. PRINCIPLES OF OPERATION</p> <p>THE ATS SPIN SCAN CAMERA UTILIZES A HIGH RESOLUTION CASSEGRAIN TELESCOPE HAVING A "PINHOLE" APERTURE FOLLOWED BY A PHOTO-MULTIPLIER TUBE. THE VIDEO RASTER IS GENERATED IN THE WEST-EAST DIRECTION BY THE SATELLITE SPIN, NOMINALLY 100 RPM, AND IN THE NORTH-SOUTH DIRECTION BY MECHANICAL TILTING OF THE TELESCOPE OPTICAL AXIS IN DISCRETE STEPS FROM +7.5 TO -7.5 DEG. THIS PROVIDES EARTH COVERAGE FROM 52 DEG N. TO 52 DEG S. LATITUDE AND FROM THE WEST LIMB TO THE EAST LIMB. THIS AREA IS COVERED BY 2000 HORIZONTAL (W TO E) TV LINES. THE TOTAL LINE SCAN PERIOD PER REVOLUTION IS 0.6 SEC. A TOTAL TIME OF 20 MIN IS REQUIRED TO SCAN 1 PICTURE AND 2 MIN TO RETRACE. A BACK-TO-BACK MODE IS ALSO POSSIBLE IN WHICH THE RETRACE IS AT THE SAME RATE AS THE FORWARD SCAN. THE SCAN MAY BE REVERSED AT ANY TIME ONLY IN THE BACK-TO-BACK MODE. A PARABOLIC PRIMARY QUARTZ MIRROR WITH A 5-IN DIAM AND A 10-INCH FL IS USED WITH A FLAT SECONDARY QUARTZ MIRROR TO PRODUCE AN IMAGE ON THE FACE OF AN APERTURE PLATE. THE .001-INCH DIAM APERTURE PROVIDES AN ANGULAR RESOLUTION OF 0.1 MILLIRADIAN. THE INSTANTANEOUS OPTICAL FOV IS 1.94 NM. THE SPACECRAFT SPIN AXIS IS NORMALLY ORIENTED PERPENDICULAR TO THE ORBIT PLANE OF THE S/C AND PARALLEL TO THE SPIN AXIS OF THE EARTH.</p> <p>32. PHENOMENA OBSERVED</p> <p>SUNLIGHT REFLECTED FROM THE EARTH'S SURFACE AND/OR CLOUDS</p> <p>33. MEASUREMENT RANGE</p> <p>DYNAMIC RANGE = 1000 FOR BRIGHTNESS RESOLUTION</p> <p>34. PRECISION AND ACCURACY</p>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.475 TO 0.630 MICRONS NA		
38. FIELD OF VIEW	39. GROUND SWATH	
15.0 BY 18.0 DEG LIMB-TO-LIMB (7500 NM) FROM GEO-SYNCH ALT		
40. ANGULAR RESOLUTION/41. SPATIAL RESOLUTION		
0.007 DEG 2.5 NM AT CENTER		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		50. INCLINATION
45. SPECIAL REQUIREMENTS	46. CIRCULAR EQUATORIAL POSIGRADE	
OPERATES ONLY DURING DAYLIGHT; HIGHLY SENSITIVE TO SWEEP DISTORT		
47. COMPONENTS		
1-INCH PHOTOMULT TUBE, 5-INCH PARABOLOID, 2-INCH FLAT MIRROR		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
16 LB	0.45 CU FT	7 WATTS
51. NUCLEAR POWER	52. PEAK POWER	53. MTBF
		54. WATTS
55. THERMAL SHIELDING	56. INTERFERENCE	57. SHIELDING
SENSITIVE		
58. CALIBRATION	59. DATA RECOVERY	60. FREQUENCY OF OBSERVATION
	REALTIME TELEMETRY	EVERY 22 MINUTES
61. TELEMETRY REQUIREMENTS		
150 KHZ VIDEO BANDWIDTH		
62. ADVANTAGES AND LIMITATIONS		
FULL EARTH DISK PHOTOGRAPHY. EARTH SYNCHRONOUS ORBIT ALLOWS COMPLETE STORM HISTORIES TO BE RECORDED.		
63. REFERENCES		
<p>1) MET DATA CATALOG FOR ATS, VOL 1. GSFC, OCT 67.***2) SUOMI, V. E. AND PARENT, R. J.: PROPOSAL FOR A SPIN SCAN CAMERA SYSTEM FOR A SYNCHRONOUS SATELLITE. JULY 1965.***3) OSTROW, H. AND WEINSTEIN, O.: A REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET. PRESENTED AT SOC OF PHOTO-OPTICAL ENGRS 13TH ANNUAL TECH SYMP. 23 AUG 68.***4) FILM DATA AVAIL FROM NAT WEATHER RECORD CTR</p>		
64. HISTORICAL REMARKS		
65. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE VHF REPEATER									
2. PRINCIPAL INVESTIGATOR CORRIGAN, J.P.									
3. CO-INVESTIGATOR GODDARD SPACE FLT CENTER 301-982-2174									
4. CONTRACT NUMBER NAS55-9593									
5. FLASH INDEX NUMBER 05265									
6. MONITOR BURKE, J.R.									
7. AGENCY NASA-HQ/OPS									
8. LOCATION HUGHES AIRCRAFT CO. RED. CULVER CITY, CALIFORNIA 12/66 NA									
9. INSTRUMENT TYPE TRANSPONDER, ACTIVE FREQUENCY-TRANSLATION									
10. APPLICATION COMM. OCEAN									
11. PURPOSE LTS 1									
12. PRIMARY-DEMONSTRATE PEASIBILITY OF PROVIDING CONTINUOUS VOICE COMMUNICATIONS LINK BETWEEN A GROUND CONTROL STATION AND AIRCRAFT WITHIN SATELLITE RANGE. **SECONDARY-DEMONSTRATE FEASIBILITY OF OPERATING A HETEROLOGICAL NETWORK IN WHICH DATA FROM SENSOR PACKAGES ARE COLLECTED AT A CENTRAL STATION AND THEN TRANSMITTED TO THE NETWORK ALL VIA SATELLITE.									
13. PRINCIPLES OF OPERATION THE VHF COMMUNICATIONS INSTRUMENT IS AN ACTIVE FREQUENCY-TRANSLATION LIMITING (CLASS C) REPEATER. THE REPEATER BOTH RECEIVES AND TRANSMITS THROUGH AN 8-ELEMENT, PHASED-ARRAY ANTENNA. INCOMING SIGNALS AT 149.22 MHZ ARE RECEIVED ON EACH DIPOLE ELEMENT ROUTED THROUGH A DIPLEXER, AMPLIFIED BY A LOW-NOISE RECEIVER, AND SHIFTED IN PHASE TO COMPENSATE FOR THE RELATIVE POSITION OF EACH DIPOLE ANTENNA. THE OUTPUTS OF EACH RECEIVER ARE IN PHASE ONLY FOR THOSE SIGNALS THAT ORIGINATE ON EARTH. REFERENCE SYNUSOIDS USED TO DRIVE THE WAVEFORM GENERATOR ARE OBTAINED FROM THE SAME PHASED-ARRAY CONTROL ELECTRONICS USED TO AIM THE MICRO-WAVE BEAM TOWARD EARTH. THE 8 RECEIVER OUTPUTS ARE SUMMED TOGETHER, FILTERED, DOWN-CONVERTED TO AN IF FREQUENCY OF 29.95 MHZ, AMPLIFIED, AND PASSED THROUGH A CRYSTAL FILTER TO LIMIT THE RECEIVER BANDWIDTH TO 100 KHZ. THE IF IS THEN AMPLIFIED, UP-CONVERTED TO 135.6 MHZ, FURTHER AMPLIFIED, AND DIVIDED INTO 8 EQUAL PARTS. EACH OF THE 8 SIGNALS IS ROUTED TO A TRANSMITTER WHERE IT IS AMPLIFIED, PHASE-SHIFTED, AND FURTHER AMPLIFIED TO A POWER LEVEL OF 5 WATTS. EACH TRANSMITTER OUTPUT IS ROUTED THROUGH ITS RESPECTIVE DIPLEXER TO ONE OF THE ANTENNA ELEMENTS.									
14. PHENOMENA OBSERVED DATA FROM OBSERVATION PLATFORMS AND GROUND CONTROL STATIONS									
15. MEASUREMENT RANGE RECEIVER NOISE FIGURE < 4.0 DB									
16. PRECISION AND ACCURACY									

135.6	TO	149.22	MHZ	NA
17.3	DEG LIMB-TO-LIMB(9700 NM) FROM GEO-SYNCH ALT			
NA	NA	SYNCH CIRCULAR EQUATORIAL POSTGRADE		
NA	NA	8 ANTENNA SYSTEMS, 8 RECEIVERS, 8 TRANSMITTERS, AND MISC EQUIP		
30 LB	90 WATTS			
SOURC/SEN	REALTIME TELEMETRY CONTINUOUS			
NA	100 KHZ BANDWIDTH			
1) VHF REPEATER EXPERIMENT-FINAL REPORT. HUGHES AIRCRAFT CO. NASA CONTRACT NO. 5-9593, FEB 1, 1967.***2) VHF REPEATER EXPERIMENT FOR ATS-C, FINAL REPORT. HUGHES AIRCRAFT CO., NASA CONTRACT NO. NAS 5-10290, NOV 1967.				
SIMILAR TO INSTRUMENT FLOWN ON ATS-3.				

1. TITLE		2. ACRONYM, 3. EXT. NO.	
WEATHER FACSIMILE EXPERIMENT		WFFAX	
(TITLE CONT.)		4. SOURCE DATE	5. EXPIRATION DATE
		11/10/69	0004
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	
WISHNA, S.	GODDARD SPACE PLT CENTER	301-982-5774	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
HOLMES, D.W.	ESSA/NESC	301-982-5774	
13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE
13. CONTRACT TYPE			
NAS5-9593			
18. MONITOR	19. AGENCY	20. PGM OFFICE	
BURKE, J.R.	NASA HDQTRS	OSSA/SCS	
22. VENDOR	23. LOCATION	24. TELEPHONE	
	HUGHES AIRCRAFT CO	25. CALL DATE	
26. INSTRUMENT TYPE	EL SEGUNDO, CALIFORNIA	12/66 NA	
TRANSPONDER			
28. APPLICATION	29. SPACECRAFT	UNC	
ET. COMM	ATS 1		

[illegible]

3. PRINCIPLES OF OPERATION

THIS WEPAX EXPERIMENT, WHICH IS SIMILAR TO THE ONE UTILIZED BY ATSS 3, IS DIFFERENT FROM OTHER ATSS 1 METEOROLOGICAL EXPERIMENTS IN THAT IT HAS NO UNIQUE FLYING HARDWARE. IT IS PART OF THE ATSS 1 VHP EXPERIMENT AND USES THE VHP TRANSPONDER AS A DATA RELAY. THIS TRANSPONDER RECEIVES AT 149.22 MHZ AND TRANSMITS AT 135.60 MHZ. THE TESTS CONDUCTED AS PART OF WEPAX INCLUDE: MASS DISTRIBUTION OF WEATHER DATA DIRECT TO APT USERS; REBROADCASTING SYNCHRONOUS ALTITUDE EARTH PICTURES VIA APT FORMAT; PROPOSED MASS COLLECTIONS OF HYDROLOGY DATA VIA ATSS 1 RELAY; AND PROPOSED LINE ISLANDS EXPERIMENT BY THE NAT CTR FOR ATMOS RES. IN OPERATION, WEATHER FACSIMILE CHARTS AND SATELLITE CLOUD COVER PICTURES ARE SENT PERIODICALLY VIA LANDLINE FROM THE NAT MET CTR, ESSA, AT SUTLAND, MD., TO THE NASA ATSS GROUND STATION AT MOJAVE CALIF. FROM THERE, THE PROCESSED INFORMATION IS TRANSMITTED TO ATSS 1 FOR RELAY TO ALL PARTICIPATING APT STATIONS WITHIN THE RECEPTION AREA. DAILY WEPAX SCHEDULES ARE PROGRAMMED TO PROVIDE MEANINGFUL DATA TO THE MAXIMUM NUMBER OF PARTICIPATING APT STATIONS POSSIBLE, NUMBERING ABOUT 50.

32. PHENOMENA OBSERVED  
VHF TRANSMISSIONS FROM ATS GROUND STATIONS GIVING WEATHER DATA  
33. MEASUREMENT RANGE  
34. PRECISION AND ACCURACY  
TRANSPONDER NOISE FIGURE 4.5 DB; BANDWIDTH 100 KHZ

### 3 KHZ INFORMATION BANDWIDTH

**SIMILAR TO ATS 3 WEEFAX.**



ATS 2

0.45 TO 0.65 MICRON NA		36. SPECTRAL RESOLUTION	37. TIME CONSTANT
SEE ITEM 31		38. GROUND SWATH	40. MILLSEC
SEE ITEM 31		39. RESOLUTION	
SEE ITEM 31		41. ALTITUDE	
HIGH ECCENTRIC MEDIUM		42. INCLINATION	
POSIGRADE			
2 CAMERAS WITH ASSOCIATED OPTICS, ELECTRONICS, TAPE RECORDER			
135 LB	22 WATTS	43. AVERAGE POWER	44. PEAK POWER
SENSITIVE	45. DATA RECOVERY	46. FREQUENCY OF OBSERVATION	
GRAY SCALE ON EACH PIC REALTIME OR DELAYED EVERY 5-10 MINUTES			
READOUT TIME 6.25 SEC, VIDEO BANDWIDTH 60 KHZ.			
SPACECRAFT FAILED TO ACHIEVE DESIRED ORBIT, LIMITING THE USEFULNESS OF THE EXPERIMENT.			
1) METEOROLOGICAL DATA CATALOG FOR THE ATS, VOL 2, GSFC, 1968.***			
2) PRESS KIT-PROJECT ATS-A, NASA RELEASE NO: 67-71, NASA WASH.D.C. MARCH 1967.***3) EASTMAN, P.H.: TWO CAMERA ADVANCED VIDICON CAMERA SUBSYSTEM (AVCS) FOR THE APPLICATIONS TECHNOLOGY SATELLITE. PRESENTED AT ATS EUG TRAINING PGM, GSFC, AUG 22-SEPT 30, 1966.***4) DATA AVAILABLE FROM NASA-GSFC, ATTN: NADUC, CODE 460.			
65. HISTORICAL REMARKS			
SATELLITE DID NOT ACHIEVE ORBIT.			
66. DIAGRAMS			

INSTRUMENT RESUME	
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
ELECTRONICS RESEARCH CENTER	
CONTRACT NUMBER NAS-10-61-0005	
ADVANCED VIDICON CAMERA SYSTEM	
(TITLE CONT)	
AVCS	
11/10/69-0005	
GODDARD SPACE FLIGHT CENTER 301-982-6563	
CO-INVESTIGATOR	
12. TYPE	
13. CONTRACT NUMBER	
14. INSTRUMENT TYPE	
15. MONITOR	
16. SPACECRAFT	
17. DATE	
18. MONITOR	
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INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	MICROWAVE TRANSPONDER		2. ACRONYM	3. EXT NO.					
(TITLE CONT.)					4. RESUME DATE	5. ACRONYM			
6. PRINCIPAL INVESTIGATOR	DARCEY, R.J.				7. ORGANIZATION	GODDARD SPACE FLT CENTER 301-982-4094			
8. CO-INVESTIGATOR					9. ORGANIZATION				
10. CONTRACT NUMBER	13. CONTRACT NUMBER				14. 1-35M INDEX NUMBER	15. ORG. NAME	16. INSTRUMENT STATUS		
18. MONITOR	BURKE, J.R.				19. AGENCY	NASA HQDTRS			
22. VENDOR	HUGHES AIRCRAFT CO.				23. LOCATION	EL SEGUNDO, CALIFORNIA 04/67 NA			
26. INSTRUMENT TYPE	TRANSPONDER, 6-GHZ (RECEIVE)				27. 4-GHZ (TRANSMIT) SHIP	UNC			
28. APPLICATION	COMM				29. APPLICATION	ATS 2			
30. PURPOSE	PRIMARY- TO EVALUATE SIMULTANEOUS TRANSMISSION OF VOICE, TELEVISION, TELEGRAPH, AND DIGITAL DATA TO SEVERAL GROUND STATIONS. ***SECONDARY- TO DETERMINE EFFECTS OF DOPPLER SHIFT DUE TO SATELLITE MOTION ON MULTIPLE ACCESS EQUIPMENT AND COMPARE EFFECTS WITH STATIONARY SATELLITE.								
31. PRINCIPLES OF OPERATION	THIS SYSTEM IS SIMILAR TO THOSE FLOWN ON ATS-1 AND ATS-3. RECEIVING AND TRANSMITTING ANTENNAS AND TRAVELING-WAVE-TUBE POWER AMPLIFIERS ARE USED IN CONJUNCTION WITH A DUAL MODE COMMUNICATIONS TRANSPONDER TO PROVIDE A SYSTEM ELEMENT CAPABLE OF ACCEPTING AND HANDLING ANY TYPE OF COMMUNICATIONS TRAFFIC OR WIDEBAND COMMUNICATIONS. THE FREQUENCY TRANSLATION MODE IS DESIGNED PRIMARILY FOR TELEVISION OR OTHER WIDEBAND USAGE IN WHICH ONE GROUND TRANSMITTER UTILIZES THE COMPLETE CHANNEL. THE USABLE BANDWIDTH IS 25 MHZ. THE MULTIPLE ACCESS MODE IS DESIGNED TO PERMIT THE INTERCONNECTION OF A LARGE NUMBER OF GROUND STATIONS IN A HIGH CHANNEL CAPACITY FREQUENCY DIVISION MULTIPLEX SYSTEM. THE TRANSPONDER SERVES AS A TELEPHONE RELAY. FREQUENCY DIVISION MULTIPLEXING OF THE VOICE CHANNELS WITH SSB IS USED FOR THE VARIOUS GROUND-TO-SPACECRAFT LINKS. THESE SIGNALS ARE CONVERTED INTO PHASE MODULATION OF A SINGLE CARRIER IN THE SPACECRAFT AND ARE RETRANSMITTED TO ALL STATIONS IN THIS FORM. EACH GROUND STATION SELECTS THE APPROPRIATE CHANNELS FROM THE RECOVERED BASEBAND CONTAINING ALL CHANNELS TO COMPLETE THE TWO-WAY INTERCONNECTIONS. THE ANTENNA USED ON THIS FLIGHT WAS DIRECTIVE HORN AND DIFFERED FROM ATS 1.								
32. PHENOMENA OBSERVED	TRANSMISSIONS FROM ATS. GROUND STATIONS AT 6 GHZ								
33. MEASUREMENTS MADE									
34. PRECISION AND ACCURACY									
35. COMMENTS	NA								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
6.212 TO 6.301 GHZ	25. MHZ	
38. FIELD OF VIEW	39. GROUND SWATH	
18.0 BY 23.0 DEG LIMB-TO-LIMB (9500 NM) FROM GEO-SYNCH ALT		
40. ANGLE OF PLACED ON RESOLUTION		
41. POINTING RATE	42. ALTITUDE	43. INCLINATION
NA	NA	44. HIGH ECCENTRIC MEDIUM
45. SPECIAL REQUIREMENTS		46. POSTGRADE
47. TRANSPONDER, ANTENNA		
48. HEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. SENSITIVE	55. INTERFERENCE	56. SHIELDING
SOURCE/SEN	57. INTERFERENCE	58. SHIELDING
59. DATA RECOVERY	60. REALTIME TELEMETRY	61. FREQUENCY OF OBSERVATION
NA	REALTIME TELEMETRY	WHEN IN VIEW
62. TELEMETRY REQUIREMENTS		
63. ADVANTAGES AND LIMITATIONS		
SATELLITE DID NOT ACHIEVE PROPER ORBIT; STABILIZATION DID NOT WORK PROPERLY		
1) PROJECT DEVELOPMENT PLAN-ATS, GSPC, GREENBELT, MD. DEC. 1965. **2) METEOROLOGICAL DATA CATALOG FOR ATS VOL 2. GSPC. GREENBELT MD., 1968.***3) TECHNICAL DATA REPORT FOR THE ATS PROGRAM. GSPC, SECTION 5, 1968.		
40. HISTORICAL REMARKS		
SIMILAR TO THAT ON ATS 1 AND 3. SATELLITE DID NOT ACHIEVE ORBIT.		

ATS 3

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE <b>IMAGE-DISSECTOR CAMERA SYSTEM</b>									
2. ACRONYM: EXP NO <b>IDCS</b>									
3. DATE <b>11/10/69 0005</b>									
4. PRINCIPAL INVESTIGATOR <b>BRANCHFLOWER, G.A.</b>									
5. CO-INVESTIGATOR <b>FOOTE, R.H.</b>									
6. CONTRACT NUMBER <b>NAS5-9671</b>									
7. ORGANIZATION <b>GODDARD SPACE FLT CENTER 301-982-5539</b>									
8. ORGANIZATION <b>ITT INDUSTRIAL LABS</b>									
9. FLASH INDEX NUMBER <b>11/67 OPERATIONAL</b>									
10. AGENCY <b>NASA HDOTRS</b>									
11. LOCATION <b>PORT WAYNE, INDIANA</b>									
12. INSTRUMENT TYPE <b>IMAGER, 1-INCH VISIBLE ELECTRICALLY-SCANNING PHOTOCATHODE</b>									
13. APPLICATION <b>NET</b>									
14. PURPOSE <b>AT5 3</b>									
<p>PRIMARY- TO TRANSMIT IN REAL TIME, DAYLIGHT CLOUD COVER INFORMATION FROM THE MAJOR PORTION OF THE FULL EARTH DISK, AND TO EVALUATE THE OPERATIONAL CHARACTERISTICS OF THE IDC IN A SPACE ENVIRONMENT, I.E. HOW ELECTRICAL SCANNING, AS OPPOSED TO MECHANICAL SCANNING, WILL PERFORM IN SPACE.</p> <p>31. PRINCIPLES OF OPERATION :</p> <p>A SIMILAR SYSTEM IS SCHEDULED TO FLY ON NIMBUS D, AND IS FLYING ON NIMBUS 3. THE 1-INCH IMAGE DISSECTOR HAS A RESOLUTION CAPABILITY OF 1300 TV-LINES. IT OPERATES IN A LINE-SCAN MODE AND CONTAINS A PHOTOCATHODE THAT IS MASKED OFF TO FORM A SLIT SLIGHTLY WIDER THAN A LINE. A SCENE IS OPTICALLY FOCUSED ON THE PHOTO-CATHODE AND PHOTOELECTRONS ARE EMITTED FROM THE SURFACE IN PORTION TO THE INCIDENT ILLUMINATION. THE PHOTOELECTRONS ARE ACCELERATED AND FOCUSED ON A PLANE WHICH CONTAINS A PIN-HOLE APERTURE. THE ELECTRON IMAGE IS DELECTED PAST THE APERTURE BY MEANS OF MAGNETIC DEFECTION. THE APERTURE SAMPLES THE ELECTRON IMAGE AND A SECONDARY-EMISSION ELECTRON-MULTIPLIER SECTION AMPLIFIES THE SIGNAL BY ABOUT 10 MILLION. THE CAMERA IS MOUNTED WITH ITS OPTICAL AXIS PERPENDICULAR TO THE SATELLITE'S AND EARTH'S ROTATIONAL AXIS. THE CAMERA'S OPTICAL AXIS TRACES A PATH ON THE EARTH FROM WEST TO EAST AS THE SATELLITE ROTATES. THE CAMERA SCANS A PROGRESSION OF LINES, ONE PER SATELLITE ROTATION, UNTIL A COMPLETE RASTER IS GENERATED. COVERAGE FROM 50 N TO 50 S LATITUDE IS OBTAINED, WITH A GROUND RESOLUTION AT THE NADIR OF 3-8 NM. SCAN LINES CAN BE TRACED EITHER PARALLEL OR PERPENDICULAR TO THE SPIN AXIS OF THE EARTH.</p> <p>32. PHENOMENA OBSERVED</p> <p>REFLECTED SUNLIGHT FROM THE EARTH'S SURFACE AND CLOUD COVER</p> <p>33. MEASUREMENT RANGE</p> <p>100 TO 1000 FOOT-LAMBERTS</p> <p>34. PRECISION AND ACCURACY</p> <p>40 DB AT 10,000 FOOT-LAMBERTS</p>									

35. SPECTRA		36. SPECTRA	
0.4	TO	0.7	MICRON
14.6 BY 14.6 DEG LIMB-TO LIMB (6040 NM) FROM GEO-SYNCH ALT			
0.01 DEG 3.8 NM AT CENTER			
SYNCH CIRCULAR EQUATORIAL POSIGRADE			
IMAGE DISSECTOR, SCANNING APERTURE, 12 STAGE ELECTRON MULTIPLIER			
20 LB 0.38 CU FT 20 WATTS			
37. SATELLITE NAME			
38. SATELLITE ORIGIN			
39. SATELLITE TYPE			
40. SATELLITE LOCATION			
41. SATELLITE POSITION			
42. SATELLITE ALTITUDE			
43. SATELLITE SPEED			
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INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	MICRONAVE TRANSPONDER		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			4. RESUME DATE	5. VERSION					
6. PRINCIPAL INVESTIGATOR	DARCEY, R. J.		7. ORGANIZATION	GODDARD SPACE FLT CENTER 301-982-4094					
8. CO-INVESTIGATOR			9. ORGANIZATION	11. TELEPHONE					
12. CONTRACT NO.	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
BURKE, J. R.	NASA HQTRS	OSSA/SCS	202-962-0581						
22. VENDOR	23. LOCATION	24. COUNTRY	25. LEAD TIME						
HUGHES AIRCRAFT CO	EL SEGUNDO, CALIFORNIA	11/67	NA						
26. INSTRUMENT TYPE	27. RESULTS								
TRANSPONDER, 6-GHZ (RECEIVE) 4-GHZ (TRANSMIT) SHP	UNC								
28. APPLICATION	29. SPACECRAFT								
COH	ATS 3								
30. PURPOSE	ATS 3								
<p>PRIMARY- TO EVALUATE SIMULTANEOUS TRANSMISSION OF VOICE, TELEVISION, TELEGRAPH, AND DIGITAL DATA TO SEVERAL GROUND STATIONS. ***SECONDARY- TO DETERMINE EFFECTS OF DOPPLER SHIFT DUE TO SATELLITE MOTION ON MULTIPLE ACCESS EQUIPMENT AND COMPARE EFFECTS WITH STATIONARY SATELLITE.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE SYSTEM IS SIMILAR TO THOSE PLOWN ON ATS-1 AND ATS-2. RECEIVING AND TRANSMITTING ANTENNAS AND TRAVELING-WAVE-TUBE POWER AMPLIFIERS ARE USED IN CONJUNCTION WITH A DUAL MODE COMMUNICATIONS TRANSPONDER TO PROVIDE A SYSTEM ELEMENT CAPABLE OF ACCEPTING AND HANDLING ANY TYPE OF COMMUNICATIONS TRAFFIC OR WIDEBAND COMMUNICATIONS. THE FREQUENCY TRANSLATION MODE IS DESIGNED PRIMARILY FOR TELEVISION OR OTHER WIDEBAND USAGE IN WHICH ONE GROUND TRANSMITTER UTILIZES THE COMPLETE CHANNEL. THE USABLE BANDWIDTH IS 25 MHZ. THE MULTIPLE ACCESS MODE IS DESIGNED TO PERMIT THE INTERCONNECTION OF A LARGE NUMBER OF GROUND STATIONS IN A HIGH CHANNEL CAPACITY FREQUENCY DIVISION MULTIPLEX SYSTEM. THE TRANSPONDER SERVES AS A TELEPHONE RELAY. FREQUENCY DIVISION MULTIPLEXING OF THE VOICE CHANNELS WITH SSB IS USED FOR THE VARIOUS GROUND-TO-SPACECRAFT LINKS. THESE SIGNALS ARE CONVERTED INTO PHASE MODULATION OF A SINGLE CARRIER IN THE SPACECRAFT AND ARE RETRANSMITTED TO ALL STATIONS IN THIS FORM. EACH GROUND STATION SELECTS THE APPROPRIATE CHANNELS FROM THE RECOVERED BASEBAND CONTAINING ALL CHANNELS TO COMPLETE THE TWO-WAY INTERCONNECTIONS. THE ANTENNA USED IS A MECHANICALLY DESIGNED PHASED ARRAY GIVING 15-18 DB OF GAIN. THE EFFECTIVE RADIATED POWER IS 830 W.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>TRANSMISSIONS FROM ATS GROUND STATIONS AT 6 GHZ</p>									
<p>33. MEASUREMENT RANGE</p>									
<p>34. PRECISION AND ACCURACY</p>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
6.212 TO 6.301 GHZ	25. MHZ	
38. FIELD OF VIEW	39. GROUND SWATH	
18.0 BY 23.0 DEG	LYMB-TO-LYMB (9500 NM) FROM GEO-SYNCH ALT	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	SYNCH CIRCULAR EQUATORIAL POSIGRADE	
47. COMPONENTS		
TRANSPONDER, ANTENNA		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. TAA TOLER
		53. MTEP
54. INTERFERENCE	55. INTERFERENCE BY	56. INTERFERENCE BY
SOURC/SEN	SENSITIVE	
57. CALIBRATION	58. DATA RECOVERY	59. BASIS OF OBSERVATION
NA	REALTIME TELEMETRY	CONTINUOUS
60. TELEMETRY REQUIREMENTS		
NA		
61. ADVANTAGES AND LIMITATIONS		
62. REFERENCES		
1) NASA PRESS KIT, ATS-C, RELEASE NO. 67-276, OCT. 1967. ***2) PROJECT DEVELOPMENT PLAN-APPLICATIONS TECHNOLOGY SATELLITE, GSFC, GREENBELT, MD. ***3) TECHNICAL DATA REPORT FOR THE ATS PROGRAM, GSFC, 1968.		
63. HISTORICAL REMARKS		
THE SYSTEM IS SIMILAR TO THOSE PLOWN ON ATS 1, 2, 4 AND 5.		
64. DIAGRAMS		

3. PL. RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
SEE ITEM 31					
38. FIELD OF VIEW		39. GROUND SWATH			
17.0		DEGLIMB-TO-LIMB (1000 NM) FROM GEO-SYNCH ALT			
35. ANTENNA RESOLUTION					
NA		43. ALTITUDE		46. INCLINATION	
4. DEG		SYNCH CIRCULAR EQUATORIAL POSIGRADE			
47. SPECIAL ACQUISITIONS					
PLATFORM ELECTRONIC PACKAGES, BATTERY, DIPOLE ANTENNA.					
45 LB		90 WATTS		53. MTBF	
SOURC/SEN		NUCLEAR THERMAL		58. SHIELDING	
NA		NA		61. FREQUENCY OF OBSERVATION	
56 BITS PER SECOND PHASE SHIFT KEYED					
63. ADVANTAGES AND LIMITATIONS					
COMPLEX AND BULKY LOCATION-COMPUTING EQUIPMENT CAN BE LOCATED AT CONVENIENT CENTER RATHER THAN AT PLATFORM.					
64. REFERENCES					
1) ATS C PRESS KIT, ATS VOL 1-6, NASA RELEASE NO. 67-276, OCT 1967. ***2) ATS TECHNICAL DATA REPORT, GODDARD SPACE FLIGHT CENTER, GREENBELT, MD. SECTION 8.4.1, JUNE 1968. ***3) LAUGHLIN, C. ET AL: OMEGA POSITION-LOCATION EQUIPMENT (OPLE). PRESENTED AT ATS SYSTEMS ENGRS TRAINING PROGRAM, GSFC, SEPT. 1966.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

1. TITLE		2. ACRONYM		3. EXP NO.	
OMEGA POSITION-AND-LOCATION EQUIPMENT EXPERIMENT		OPLE		11/10/69 0003	
6. PRINCIPAL INVESTIGATOR		7. CO-INVESTIGATOR		8. TELEPHONE	
LAUGHLIN, C.		GODDARD SPACE FLT CENTER 301-982-6962		10. TELEPHONE	
HILTON, C.E.		GODDARD SPACE FLT CENTER 301-982-6969		11. STATION	
12. CONTRACT NUMBER		13. FLASHING NUMBER		14. DATE	
11/67 OPERATIONAL		11/67 OPERATIONAL		15. DATE	
16. MONITOR		17. AGENCY		18. TELEPHONE	
BURKE, J.R.		NASA HQTRS		OSSA/SCS 202-962-0581	
19. VENDOR		20. LOCATION		21. DATE	
HUGHES AIRCRAFT CO		EL SEGUNDO, CALIFORNIA		11/67 NA	
22. INSTRUMENT TYPE		23. APPLICATION		24. SPACECRAFT	
TRANSPONDER, VHF		UNC		25. SPACECRAFT	
26. PURPOSE		27. AGENCY		28. DATE	
NET, OCEAN, NAV		ATS 3		29. DATE	
PRIMARY - TO DEMONSTRATE THE FEASIBILITY OF USING THE OMEGA NAVIGATIONAL SYSTEM IN CONJUNCTION WITH SYNCHRONOUS SATELLITES TO ESTABLISH A GLOBAL LOCATION AND DATA COLLECTION SYSTEM.					
31. PRINCIPLES OF OPERATION					
AN OPERATIONAL SYSTEM CONSISTS OF: (1) AN OPLE CONTROL CENTER; (2) A SYNCHRONOUS SATELLITE; AND (3) THE OPLE PLATFORM ELECTRONIC PACKAGES (PEP'S) WORKING IN CONJUNCTION WITH THE OMEGA NETWORK. DURING A TYPICAL INTERROGATION PERIOD, GSFC TRANSMITS A PRE-PROGRAMMED PLATFORM INTERROGATION SEQUENCE WHICH IS RELAYED (VHF) VIA ATS TO OPLE PLATFORMS. THE ATS 3 VHF TRANSPONDER RECEIVES AT 149.22 MHZ AND TRANSMITS AT 135.6 MHZ WITH A 40-WATT MAX OUTPUT. IT CAN OPERATE ALSO IN THE 450 MHZ BAND. EACH PLATFORM HAS ITS OWN BINARY CODE ADDRESS. AFTER RECEIPT OF THEIR OWN PROPER ADDRESSES, THE CORRECTLY ADDRESSED PEP'S SIMULTANEOUSLY TRANSMIT THEIR ASSIGNED ACQUISITION REFERENCE A/R SIGNALS. AFTER THE ACQUISITION PERIOD, THE A/R TONE IS MODULATED WITH METEOROLOGICAL OR PLATFORM STATUS DATA BY PHASE-SHIFT KEYING. FOLLOWING THE DATA TRANSMISSION PERIOD, THE A/R TONE IS REDUCED IN POWER LEVEL AND THE OMEGA TRANSMISSION MODE IS INITIATED. IN THIS MODE, TWO PAIRS OF VLF OMEGA SIGNALS ARE RECEIVED BY THE RECEIVERS ON THE PLATFORMS AND CONVERTED TO VHF FOR TRANSMISSION TO ATS 3 AND THEN GODDARD. THE RELATIVE PHASE BETWEEN THE TWO SIGNALS OF A PAIR DETERMINE A LINE AND THE INTERSECTION OF THE 2 LINES GIVE THE LOCATION TO WITHIN 1 MI (DAYTIME), 2 MI (NIGHT).					
32. PHENOMENA OBSERVED					
DATA FROM OBSERVATION PLATFORMS					
33. MEASUREMENT RANGE					
34. PRECISION AND ACCURACY					
POSITION TO ONE MILE IN DAYTIME; TWO MILES NIGHTTIME					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
SPIN-SCAN CLOUD-COVER CAMERA		SSCC							
(TITLE CONT.)		4. RESUME		5. JOURNAL					
MULTICOLOR		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
SUOMI, DR. V. E.		UNIVERSITY OF WISCONSIN		608-262-5938					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
PARENT, DR. R. J.		UNIVERSITY OF WISCONSIN		608-262-5939					
12. CONTRACT NUMBER		13. CONTRACT NUMBER		14. STATUS					
15. MONITOR		16. AGENCY		17. DATE					
BURKE, J.R.		NASA HQ/OPS		055A/SCS		202-962-0581			
22. VENDOR		23. LOCATION		24. DATE					
SANTA BARBARA RCS CTR		GOLFPT, CALIFORNIA		11/67		NA			
28. INSTRUMENT TYPE		29. APPLICATION		30. SPACECRAFT					
IMAGER, THREE 1-INCH PHOTOMULTIPLIERS, VISIBLE-COLOR				ATS-3					
31. PURPOSE		32. PRINCIPLES OF OPERATION		33. MEASUREMENT RANGE					
NET									
<p>PRIMARY- TO OBTAIN HIGH RESOLUTION COLOR PHOTOGRAPHS FROM SYNCHRONOUS ALTITUDE SO THAT CLOUD DEVELOPMENT, CLOUD DISPLACEMENTS, AND IN THE TERMINATOR ZONE, CLOUD ALTITUDES, CAN BE DETERMINED FOR USE IN STUDIES OF TROPICAL CONVECTION.***SECONDARY-DETERMINE HORIZONTAL EXTENT OF OCEAN CURRENTS; SCATTERING OF THE ATMOSPHERE IN BROAD SPECTRAL BANDS; VIEW MID-LATITUDE STORMS.</p> <p>THE MULTI-COLOR SPIN SCAN CAMERA IS AN ADVANCEMENT OVER THE MONOCHROMATIC SPIN SCAN CAMERA ON ATS 1. VISIBLE LIGHT REFLECTED FROM THE EARTH IS GATHERED BY A 5-INCH DIAMETER F/3 DALL-KIRKHAM TELESCOPE AND FOCUSED ALTERNATELY ON A SET OF THREE 0.0015 INCH DIAMETER FIELD-DEFINING APERTURES. AN APERTURE PASSES EITHER RED, GREEN, OR BLUE DETERMINED BY A COMBINATION OF THE NATURAL CUTOFFS OF THE DIFFERENT DETECTOR PHOTOCATHODES, CORNING FILTER-GLASS DIVERGING LENSES AND INTERFERENCE FILTERS. THE SPINNING MOTION OF THE SPACECRAFT PROVIDES THE CAMERA SCAN PARALLEL TO THE EQUATOR. THE CAMERA STEPS ONE INCREMENT IN LATITUDE FOLLOWING EACH SPACECRAFT REVOLUTION PROVIDING POLE-TO-POLE COVERAGE IN 2400 SCAN LINES. WITH A SPIN RATE OF 100 RPM, THE TIME TO COVER ONE FRAME IS 24 MINUTES. RETRACE TAKES 4 MINUTES. THE SCAN CAN ALSO BE OPERATED IN A BACK-TO-BACK MODE. OPERATION HERE IS IDENTICAL TO THE NORMAL MODE DURING NORTH-TO-SOUTH OPERATION BUT DURING RETRACE THE SOUTH-TO-NORTH STEP IS AT THE SAME RATE AS THE FORWARD TRACE AND USEFUL VIDEO IS PRODUCED. THE OUTPUTS FROM THE THREE PHOTOTUBES ARE MULTIPLEXED AND TRANSMITTED TO EARTH OVER THE SHF WIDE-BAND LINK.</p>									
34. PRECISION AND ACCURACY		35. PHENOMENA OBSERVED		36. INTENSITY OF EARTH'S SPECTRAL REFLECTION IN THE BLUE, GREEN, RED					

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.390 TO 0.700 MICRON					
38. FIELD OF VIEW		39. GROUND SWATH			
15.0 BY 15.0 DEG LIMB-TO-LIMB (10000 NM) FROM GEO-SYNCH ALT					
40. ANGULAR RESOLUTION <sup>1</sup> SPATIAL RESOLUTION					
0.006 DEG 2 NM AT CENTER					
41. POINTING ACCURACY		42. POINTING RATE		43. INCLINATION	
NA					
44. SPECIAL REQUIREMENTS		45. SPECIAL REQUIREMENTS		46. SPECIAL REQUIREMENTS	
47. COMPONENTS		48. COMPONENTS		49. COMPONENTS	
TELESCOPE, 3 PHOTOMULTIPLIER LIGHT DETECTORS, STEP DRIVE MECHANISM		50. AVERAGE POWER		51. STANDBY POWER	
23 LB		10 WATTS		22 WATTS	
52. WEIGHT		53. VOLUME		54. INTERFERENCE	
55. INTERFERENCE		56. INTERFERENCE		57. SHIELDING	
58. CALCULATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
61. TELEMETRY REQUIREMENTS		62. TELEMETRY REQUIREMENTS		63. TELEMETRY REQUIREMENTS	
500 KBIT, 3 TDM CHANNELS OF 150 KBIT EACH.		REALTIME TELEMETRY		EVERY 28 MINUTES	
64. ADVANTAGES AND LIMITATIONS		65. ADVANTAGES AND LIMITATIONS		66. ADVANTAGES AND LIMITATIONS	
REDUCTION IN SIZE AND WEIGHT OVER COMBINED TELESCOPE-PHOTOMULTIPLIER TUBE ASSEMBLY.		67. REFERENCE		68. REFERENCE	
1) ATS METEOROLOGICAL DATA CATALOG. GSFC.***2) MINZNER, R.A. ED: INTERIM REPORT ON SATELLITE MET. INSTRUMENTS, PN-6713, NASA/ERC, PR67.***3) SUOMI, V. AND PARENT, R.J.: PROPOSAL AND SUPPLEMENT FOR SPIN SCAN CAMERA FOR ATS C. UNIV. OF WISC. NOV 65, JUN 66.***4) DATA AVAILABLE FROM ESSA, ASHEVILLE, N.C. FOR B/W AND AT NIMBUS/ATS DATA UTILIZATION CENTER, GSFC, FOR COLOR.		69. HISTORICAL REMARKS		70. HISTORICAL REMARKS	
ADVANCEMENT OVER MONOCHROMATIC SPIN-SCAN CAMERA (SSCC) ON ATS 1.		71. ADVANCEMENT OVER MONOCHROMATIC SPIN-SCAN CAMERA (SSCC) ON ATS 1.		72. ADVANCEMENT OVER MONOCHROMATIC SPIN-SCAN CAMERA (SSCC) ON ATS 1.	





INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM 3. EXP NO								
WEATHER FACSIMILE EXPERIMENT	WEFAX								
(TITLE CONT.)	4. RESUME DATE 5. NUMBER								
	11/10/69 0004								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
HOLMES, D.W.	ESSA/NESC	301-440-7405							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
WISHNA, S.	GODDARD SPACE FLT CENTER	301-982-5774							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. DATE	15. STATUS	16. OPERATIONAL					
				11/67 OPERATIONAL					
18. MONITOR	19. AGENCY	20. POM OFFICE	21. TELEPHONE	22. LOCATION					
BURKE, J.R.	NASA	HDOTRS	OSSA/SCS 202-962-0581	23. LEAD TIME					
22. VENDOR	24. FLIGHT								
HUGHES AIRCRAFT CO	EL SEGUNDO, CALIFORNIA 11/67 NA								
26. INSTRUMENT TYPE	27. INSTRUMENT								
TRANSPONDER, VHF	28. APPLICATION								
	29. SPACECRAFT								
30. PURPOSE	31. APTS 3								
<p>PRIMARY - TO TRANSMIT FACSIMILE WEATHER DATA THROUGH THE APTS 3 SATELLITE TO PARTICIPATING GROUND STATIONS**SECONDARY-TO TRANSMIT SELECTED SPIN-SCAN CAMERA PICTURES VIA SATELLITE TO APT GROUND READOUT STATIONS-TO EXPLORE FEASIBILITY OF INCREASING THE AMOUNT OF DATA AVAILABLE TO APT GROUND STATIONS FROM ESSA AND NIREUS SATELLITES.</p> <p>31. PRINCIPLES OF OPERATION</p> <p>THIS WEFAX EXPERIMENT, WHICH IS SIMILAR TO THE ONE UTILIZED BY APTS 1, IS DIFFERENT FROM OTHER APTS 3 METEOROLOGICAL EXPERIMENTS IN THAT IT HAS NO UNIQUE FLYING HARDWARE. IT IS PART OF THE APTS 3 VHF EXPERIMENT AND USES THE WEFAX TRANSPONDER AS A DATA RELAY. THIS TRANSPONDER RECEIVES AT 149.22 MHZ AND TRANSMITS AT 135.60 MHZ. THE FEASIBILITY TESTS CONDUCTED BY WEFAX INCLUDE MASS DISTRIBUTION OF WEATHER DATA DIRECT TO APT USERS; REBROADCASTING SYNCHRONOUS ALTITUDE EARTH PICTURES VIA APT FORMAT; AND PROPOSED MASS COLLECTIONS OF HYDROLOGY DATA VIA APTS 3 RELAY. IN OPERATION, WEATHER FACSIMILE CHARTS AND SATELLITE CLOUD COVER PICTURES ARE SENT PERIODICALLY VIA LAND LINE FROM THE NATIONAL METEOROLOGICAL CENTER, ESSA, AT SUITLAND, MD., TO THE NASA APTS GROUND STATION AT MCJAVE, CALIFORNIA. FROM THERE THE WEFAX FIELD CENTER TRANSMITS THE DATA TO THE SPACECRAFT AT THE RATE OF 240 SCANS PER MINUTE, AND THE APTS THEN RELAYS THE DATA. PARTICIPATING APT STATIONS RECEIVE THESE TRANSMISSIONS AND EVALUATE THEM FOR USEFULNESS. COPIES OF THE RECEIVED ITEMS ARE SENT TO GODDARD FOR CORRELATING QUALITY WITH FACTORS SUCH AS TRANSMISSION DISTANCE AND ANTENNA ANGLE. POTENTIALLY 100 TO 150 RECEIVING SITES CAN BE INCLUDED IN THE AREA OF COVERAGE.</p> <p>32. PHENOMENA OBSERVED</p> <p>VHF TRANSMISSIONS FROM APTS GROUND STATIONS GIVING WEATHER DATA</p> <p>33. MEASUREMENT RANGE</p> <p>34. PRECISION AND ACCURACY</p> <p>TRANSPONDER NOISE FIGURE 4.5 DB, BANDWIDTH 100 KHZ</p>									

36. SPECTRAL RANGE	37. SPECTRAL RESOLUTION	38. TIME CONSTANT
149.22 AND 135.0 MHZ		
39. FIELD OF VIEW	40. GROUND SWATH	
17.3	DEGLIMB-TO-LIMB (9700 NM) FROM GEO-SYNCH ALT	
41. ANGLE OF RESOLUTION-1 SPATIAL RESOLUTION		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
45. SPECIAL REQUIREMENTS	SYNCH CIRCULAR EQUATORIAL POSIGRADE	
47. COMPONENTS		
VHF TRANSPONDER, ANTENNA SYSTEM, DIPLEXER		
49. WEIGHT	50. AVERAGE POWER	51. PEAK POWER
29 LB	90 WATTS	50 NITBF
52. TRANSMITTER	53. ANTENNA	54. INTERFERENCE
SOURC/SEN	55. DATA RECOVERY	56. OBSERVATION
57. TELESCOPE FOUNDATIONS	APPROX 2 HOURS/DAY	
2 KHZ INFORMATION BANDWIDTH		
58. ADVANTAGES AND LIMITATIONS		
MORE SENSITIVE TO SMALL SIGNALS THAN APTS 1 TRANSPONDER		
59. REFERENCES		
<p>1) APTS C PRESS KIT, NASA RELEASE NO. 67-276, OCT., 1967.***2) CORRIGAN, J.P.: THE VHF EXPERIMENT, PRESENTED AT APTS SYSTEM ENGINEERING TRAINING PROGRAM, GSFC, AUG 1966.***3) DRUMMOND, R. WEATHER FACSIMILE EXPERIMENT. PRESENTED AT APTS SYSTEMS ENGRS. TRAINING PROGRAM, GSFC, SEPT 66.</p>		
60. HISTORICAL REMARKS		
SIMILAR TO APTS 1 WEFAX.		

ATS 4

35. SPECTRAL BAND	0.3	TO	0.7	MICRON	NA	36. SPECTRAL RESOLUTION	1.7 TIME CONSTANT
37. FIELD OF VIEW	DEGLIMB-TO-LIMB (1700 NM) FROM GEO-SYNCH ALT				450.0	MILISEC	
38. GROUND SWATH							
39. SPATIAL RESOLUTION	4. IK						
40. ALTITUDE	0.005 DEG 2.16 NM AT CENTER						
41. ORBITAL VELOCITY	0.2						
42. SPECIAL REQUIREMENTS	DEG/SEC SYNCH CIRCULAR EQUATORIAL POSIGRADE						
43. ORBITAL PERIOD							
44. ALTITUDE							
45. INCLINATION							
46. AVERAGE POWER	56 LB						
47. WFTG	21 WATTS						
48. PEAK POWER	48 WATTS						
49. INTERFERENCE	50. SHIELDING						
51. DATA RECOVERY	52. FREQUENCY OF OBSERVATION						
53. TELEMETRY REQUIREMENTS	GRAY-SCALE CALIBRATOR						
54. REALTIME TELEMETRY	CONTINUOUS						
55. HISTORICAL REMARKS	60 KHZ VIDEO BANDWIDTH						
56. REFERENCES	NIGHT-TIME IMAGING.						
57. SPACECRAFT FAILED TO REACH SYNCHRONOUS ORBIT	1) OSTROW, H. AND WEINSTEIN, O.: A REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY; PRESENTED AT SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS 13TH ANNUAL TECHNICAL SYMPOSIUM, AUG. 1968. ***2) SHAW, D.B.: THE IMAGE ORTHON CAMERA. PRESENTED AT ATS SYSTEMS ENGINEERS TRAINING PROGRAM, GSPC, SEPT. 1966.						
58. DIAGRAMS							

INSTRUMENT RESUME			
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION			
ELECTRONIC RESEARCH CENTER			
CAMBRIDGE MASSACHUSETTS			
1. TITLE	2. AUTHORITY	3. EXTENT	4. DATE
DAY/NIGHT CAMERA SYSTEM	DNCS		11/10/69 0004
5. PRINCIPAL INVESTIGATOR	6. ORGANIZATION	7. TELEPHONE	8. TELEPHONE
MOODY, J.C.	GODDARD SPACE FLT CENTER	301-982-6908	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. DATE	15. STATUS
		08/68	POST FLIGHT
16. MONITOR	17. AGENCY	18. PGM OFFICER	19. TELEPHONE
BURKE, J.R.	NASA HDOTRS	OSMA/SCS	202-962-0581
20. VENDOR	21. LOCATION	22. DATE	23. TIME
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY	08/68	NA
24. INSTRUMENT TYPE	IMAGER, 2-INCH VISIBLE IMAGE-ORTHICON		
25. APPLICATION	MET		
26. PURPOSE	ATS 4		
PRIMARY - TO EXTEND VIEWING OF EARTH'S CLOUD COVER ON A REGULAR BASIS TO INCLUDE NIGHT TIME IMAGING; TO EXAMINE OVERALL FEASIBILITY OF A HIGH RESOLUTION CONTINUOUS SURVEILLANCE CAMERA SYSTEM OPERATING FROM SYNCHRONOUS ALTITUDE.			
27. PRINCIPLES OF OPERATION			
<p>THE INCOMING LIGHT IS REFLECTED FROM THE PRIMARY MIRROR, COLLECTED AT THE OBJECTIVE LENS AND PASSED THROUGH A BEAM-SPLITTER. IT IS THEN SIMULTANEOUSLY INCIDENT ON A PHOTOMULTIPLIER TUBE (PMT) AND THE IMAGE ORTHON TUBE. A RETRACTABLE SUNSHADE IS AVAILABLE TO PREVENT STRAY LIGHT FROM ENTERING THE CAMERA'S FIELD OF VIEW WHILE IMAGING NIGHTTIME SCENES. THE IMAGE ORTHON SATURATES UNDER NOMINAL FULL MOON CONDITIONS. WHEN THE SCENE ILLUMINATION IS ABOVE THIS LEVEL, ATTENUATION, IN THE FORM OF TWO TAPERED, DOUBLE CYCLE, COUNTER ROTATING NEUTRAL DENSITY FILTERS, IS INTRODUCED INTO THE OPTICAL PATH. THE PMT GENERATES A SIGNAL PROPORTIONAL TO THE AVERAGE SCENE ILLUMINATION OVER THE AREA VIEWED BY THE CAMERA. THE SIGNAL FROM THE PMT FEEDS AN AUTOMATIC LIGHT CONTROL CIRCUIT WHICH VARIES THE FILTERS UNTIL THE PMT SIGNAL REACHES THE DESIRED VALUE. THE OPTICS ARE STEERABLE BY MEANS OF GROUND COMMAND. STEPS OF 0.1 DEG THROUGH AN ANGLE OF PLUS-MINUS 12.5 DEG IN BOTH PITCH AND ROLL ARE POSSIBLE. THUS THE CAMERA IS ABLE TO TRACK AREAS OF METEOROLOGICAL INTEREST KNOWING THE SPACECRAFT ATTITUDE AND THE LOCATION OF THE DESIRED VIEWING AREA. FULL EARTH COVERAGE CAN BE ACHIEVED BY TAKING A SERIES OF OVERLAPPING PICTURES.</p>			
28. PHENOMENA OBSERVED			
VISIBLE LIGHT REFLECTED FROM EARTH AND CLOUD COVER			
29. MEASUREMENT RANGE			
0.0001 TO .10000 FOOT-LAMBERTS			
30. PRECISION AND ACCURACY			
800 LINES HORIZONTAL RESOLUTION, 620 LINES VERTICAL RESOLUTION			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. INSTRUMENT		5. VERSION	
MICROWAVE TRANSPONDER		NTRAN						0005	
(TITLE CONT)									
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CONTRACT NUMBER		10. FLASH INDEX NUMBER	
DARCEY, R.J.		GODDARD SPACE FLT CENTER		301-982-4094				11. STATUS	
B. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		12. CONTRACT TYPE		13. DATE	
								08/68	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. LOCATION	
BURKE, J.R.		NASA HQ/TS		OSSA/SCS		202-962-0581		23. DATE	
22. VENDOR		21. LOCATION		24. DATE		25. LEAD TIME		26. INSTRUMENT TYPE	
HUGHES AIRCRAFT CO		EL SEGUNDO, CALIFORNIA		08/68		NA		27. SECURITY	
28. INSTRUMENT TYPE		29. APPLICATION		30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED	
TRANSPONDER, 6-GHZ (RECEIVE) 4-GHZ (TRANSMIT) SHP		ATS 4		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. SPECTRAL RANGE	
36. APPLICATION		37. TIME CONSTANT		38. SPECTRAL RESOLUTION		39. GROUND SWATH		40. ANGULAR RESOLUTION	
				30. MHZ		18.0 BY 23.0 DEG		1.0	
				41. ALTITUDE		42. ECCENTRICITY		43. INCLINATION	
				MED		MEDIUM		POSIGRADE	
				44. AVERAGE POWER		45. STANDBY POWER		46. PEAK POWER	
				20 WATTS				53. MTBF	
				47. COMPONENTS		48. WEIGHT		49. VOLUME	
				TRANSPONDER, TWO ANTENNAS		50. MAGNETIC INTERFERENCE		51. NUCLEAR INTERFERENCE	
				52. CALIBRATION		53. DATA RECOVERY		54. FREQUENCY OF OBSERVATION	
				NA		REALTIME TELEMETRY		CONTINUOUS	
				55. TELEMETRY REQUIREMENTS		56. DATA RECOVERY		57. SENSITIVE	
				NA					
				58. ADVANTAGES AND LIMITATIONS		59. SECOND STAGE FAILURE ON ATS 4 PREVENTED SPACECRAFT FROM REACHING SYNCHRONOUS ORBIT.		60. REFERENCES	
				61. HISTORICAL REMARKS		62. SIMILAR SYSTEMS ON ATS 1, 2 AND 3: IDENTICAL ON ATS 5		63. DIAGRAM	
				64. PROJECT DEVELOPMENT PLAN-APPLICATIONS TECHNOLOGY SATELLITE, GSFC GREENBELT, MD.***3) TECHNICAL DATA REPORT FOR THE ATS PROGRAM, SEC. 7, GSFC, 1968.		65. NASA PRESS KIT, ATS D, RELEASE NO. 68-127, JULY 21, 1968.***2) PROJECT DEVELOPMENT PLAN-APPLICATIONS TECHNOLOGY SATELLITE, GSFC GREENBELT, MD.***3) TECHNICAL DATA REPORT FOR THE ATS PROGRAM, SEC. 7, GSFC, 1968.			

ATS 5

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELCINS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO.					
MICROWAVE TRANSPONDER		MTRN		11/10/69 0005					
(TITLE CONT.)		4. RESUME		5. VIBRATION					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
DARCEY, R.J.		GODDARD SPACE FLIGHT CTR		301-982-4094					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. STATUS			
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE			
BURKE, J.R.		NASA HDOTRS		OSSA/SCS		202-962-0581			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
HUGHES AIRCRAFT CO		EL SEGUNDO, CALIFORNIA		08/69/NA					
26. INSTRUMENT TYPE		27. INSTRUMENT		28. APPLICATION		29. SPACECRAFT			
TRANSPONDER, 6-GHZ (RECEIVE)		4-GHZ (TRANSMIT) SHP		UNC					
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE			
COM		ATS 5							
<p>PRIMARY--TO DETERMINE THE USEFULNESS OF SHP AS A WIDEBAND TRANSMISSION MEDIUM, ESPECIALLY TO EVALUATE THE TRANSMISSION OF MONOCHROME AND COLOR TELEVISION AND THE SIMULTANEOUS TRANSMISSION OF MANY VOICE, TELETYPE AND DATA CHANNELS FROM SEVERAL GROUND STATIONS. ***SECONDARY--TO DETERMINE AND EVALUATE THE PHENOMENA AFFECTING WIDEBAND SHP TRANSMISSIONS.</p> <p>THE SYSTEM CONSISTS OF TWO PLANAR ARRAY ANTENNAS--ONE TO RECEIVE AT EITHER 6.212 OR 6.301 GHZ AND ONE TO TRANSMIT AT 4.120 OR 1.550 GHZ--AND TWO TRANSPONDERS EACH CONTAINING TWO TRAVELING WAVE TUBE (TWT) AMPLIFIERS THAT CAN OPERATE SINGLY OR IN PARALLEL. THE 4.120 GHZ SYSTEM CONTAINS TWO 4 W TWT'S, AND THE 1.550 GHZ SYSTEM CONTAINS TWO 12.5 W TWT'S. EACH ANTENNA HAS A HALF-BEAMWIDTH OF 23 DEG AND A GAIN OF 16.5 DB. USING THE 8 W TRANSMITTER AND INCLUDING LOSSES, THE EFFECTIVE RADIATED POWER IS 23.7 DBW (234 W). THE TRANSPONDERS CAN BE USED IN EITHER OF TWO MODES: A MULTIPLE ACCESS (MA) MODE OR A SIMPLE FREQUENCY TRANSLATION (FT) MODE. WITH A BANDWIDTH OF 4.5 MHZ, THE MA MODE SIMULTANEOUSLY RELAYS, BETWEEN SEVERAL GROUND STATIONS, UP TO 1200 3.1 KHZ WIDE VOICE, DATA OR TELETYPE CHANNELS USING SSB ON THE UPLINK AND PHASE MODULATION (PM) ON THE DOWNLINK. THE FT MODE, USING FM/PM SIGNALS, HAS A BANDWIDTH OF 25 MHZ AND IS USED PRIMARILY TO EVALUATE RELAYS OF MONOCHROME OR COLOR TELEVISION BROADCASTS. THIS MODE CAN ALSO BE USED IN A SECOND FREQUENCY DIVISION MULTIPLEXING SYSTEM TO HANDLE UP TO 1200 CHANNELS OF VOICE OR DATA. THE MODE USED IS SELECTED FROM THE GROUND. AN OMNIDIRECTIONAL ANTENNA IS USED WHILE S/C SPINS.</p> <p>TRANSMISSIONS FROM ATS GROUND STATIONS AT 6 GHZ</p>									
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
6.212 AND 6.301 GHZ		25.		MHZ	
39. FIELD OF VIEW		40. GROUND SWATH			
18.0 BY 23.0 DEG		LIMB-TO-LIMB 9700 NM FROM GEO-SYNCH ALT			
41. ANGULAR RESOLUTION		42. SPATIAL RESOLUTION			
43. POINTING ACCURACY		44. POINTING RATE		45. ALTITUDE	
		SYNCH CIRCULAR		EQUATORIAL POSIGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
TRANSPONDER, TWO ANTENNAS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. AS INTERFERENCE		56. SHIELDING	
SOTEC/SEN		20 WATTS		50 KHR	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
NA		REALTIME TELEMETRY		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
NA					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
<p>1) NASA PRESS KIT, ATS-D, RELEASE NO. 68-127, JULY 21, 1968.***2) PROJECT DEVELOPMENT PLAN--APPLICATIONS TECHNOLOGY SATELLITE, GSPC, GREENBELT, MD.***3) TECHNICAL DATA REPORT FOR THE ATS PROGRAM, SEC. 7, GSPC, 1968.</p>					
65. HISTORICAL REMARKS					
SIMILAR SYSTEMS ON ATS 1, 2 AND 3: IDENTICAL ON ATS 4					
66. DIAGRAMS					

ERTS



INSTRUMENT RESUME				
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS				
1. TITLE	2. ACRONYM	3. EXP NO		
RETURN-BEAM VIDICON CAMERA SYSTEM (TITLE CONT.)	RBV			
	4. RESUME	5. VERSION		
	11/10/69	0005		
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE		
WEINSTEIN, O.	GODDARD SPACE FLT CENTER	301-982-4108		
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE		
RAGLAND, T.	GODDARD SPACE FLT CENTER	301-982-2493		
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE
CPIP	RAS5-11621	10/68		ADVAN DSGN
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	
GEORGE, T.	NASA HQ/OTRS	LOSSA/SRB	202-963-5039	
22. VENDOR	23. LOCATION	24. FLIGHT	25. LEAD TIME	
RCA ASTRO-ELECTRONICS	PRINCETON, N.J.	01/72		
26. INSTRUMENT TYPE	27. SECURITY			
IMAGER, 2-INCH HIGH-RESOLUTION RETURN-BEAM-VIDICON	UNC			
28. APPLICATION	29. SPACECRAFT			
ERSP, HET	ERTS			
30. PURPOSE				
<p>PRIMARY-TO PROVIDE CONTINUOUS, OVERLAPPING MULTI-SPECTRAL PHOTOGRAPHIC COVERAGE OF THE EARTH'S SURFACE ALONG THE ORBITAL TRACK AND REPEATED OBSERVATIONS OF ANY GIVEN AREA WITHIN THE MINIMUM TIME INTERVAL POSSIBLE.</p>				
<p>31. PRINCIPLES OF OPERATION</p> <p>THE RBVC, AS PROPOSED, IS A 3 CAMERA SYSTEM SPANNING THE VISIBLE SPECTRUM IN 3 BANDS: .475-.575, .580-.680, AND .690-.830 MICRON. SPECTRAL BANDS ARE OBTAINED THROUGH USE OF FILTERS IN ACQUISITION OPTICS. AN ELECTRONICALLY TRIGGERED, VARIABLE-SPEED, FOCAL-PLANE SHUTTER ALLOWS PICTURE-TAKING OVER A WIDE RANGE OF SCENE BRIGHTNESS AND PROVIDES UNIFORM EXPOSURE OF THE VIDICON. THIS SENSOR, A 2-INCH RETURN BEAM VIDICON, COMBINES THE VIDICON AND ORTHON CON TUBE. THE VIDEO OUTPUT IS DERIVED FROM THE RETURN SCANNING BEAM. A PHOTOCONDUCTIVE SURFACE CHARGES THE TARGET SURFACE IN PROPORTION TO THE LIGHT RECEIVED. THEN AS THE ELECTRON SCANNING BEAM TRAVERSES THE TARGET, THE CHARGE MODULATES THIS BEAM WHICH IS THEN AMPLIFIED BY AN ELECTRON MULTIPLIER. THE VIDEO OUTPUT OF THE SYSTEM MAY BE FED DIRECTLY TO THE MODULATOR OF THE SPACECRAFT COMMUNICATION SYSTEM. THE CAMERAS ARE POINTED AT NADIR AND A NEW SCENE IS IMAGED ON THE PHOTO CONDUCTOR SURFACES EVERY 25 SEC. THE RESOLUTION CAPABILITY OF THE SYSTEM IS 4500 TV LINES, EQUIPPED WITH A 130 MM FL, F/2.8 LENS, EACH FRAME WILL COVER AN AREA OF 100 X 100 NM AT A RESOLUTION OF ABOUT 150 FEET PER TV LINE FROM 496 NM ALTITUDE. THE SENSOR IS CAPABLE OF RESOLVING 90 LINE-PAIRS/MILLIMETER.</p>				
32. PHENOMENA OBSERVED				
RADIATION FROM THE SURFACE OF THE EARTH IN THE VISIBLE SPECTRUM				
33. MEASUREMENT RANGE				
DYNAMIC RANGE= 100 AT 0.1 MICROWATT-SEC/SQ-CM; 13 GRAY LEVELS				
34. PRECISION AND ACCURACY				
SIN= 35 DB AT 0.1 MICROWATT-SEC/SQ-CM W/O APERTURE CORRECTION				

35. SPECTRAL RANGE	0.475 TO 0.830 MICRON	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	36. GROUND SWATH		
11.5 BY 11.5 DEG	100 NM BY 100 NM FROM 500 NM ALTITUDE		
39. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
0.002 DEG	100 FEET PER TV-LINE FROM 500 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
3 RBV CAMERAS (CAMERA HEAD + ELECTRONICS), RECORDER, TRANSMITTER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
130 LB	3.0 CU FT	130 WATTS	66 WATTS
52. PEAK POWER	53. MTBF	54. INTERFERENCE	55. INTERFERENCE
		MAGNETIC	NUCLEAR
		SENSITIVE	SHIELDING
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
NO IN-FLIGHT CALIBRATION	DELAIED TELEMETRY	ON COMMAND	
59. TELEMETRY REQUIREMENTS			
1 MINUTE PER ORBIT BASED ON AVERAGE OF 14 ORBITS PER DAY			
60. ADVANTAGES AND LIMITATIONS			
HIGH RESOLUTION MULTI-SPECTRAL PHOTOGRAPHY WITH 1 YEAR OPERATIONAL CAPABILITY			
61. REFERENCES			
1) RCA ASTRO-ELECTRONICS DIV. TECHNICAL REPORTS, 1968.			
62. HISTORICAL REMARKS			
63. DIAGRAMS			

ESSA 1

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
VIDICON CAMERA SYSTEM	VCSW								
4. RESUME DATE	5. VISION DATE								
11/10/69	0004								
WIDE-ANGLE	7. ORGANIZATION	8. TELEPHONE							
6. PRINCIPAL INVESTIGATOR	GODDARD SPACE FLT CENTER	301-982-5716							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GLOVER, J. C.	NESC (ESSA)		301-440-7543						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, N. J.	02/66							
26. INSTRUMENT TYPE									
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON									
28. APPLICATION	29. SPACECRAFT								
RET	ESSA 1								
30. PURPOSE									
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS. THE FIRST SATELLITE IN THE TIROS OPERATIONAL SATELLITE (TOS) SYSTEM.									
31. PRINCIPLES OF OPERATION									
<p>THE ESSA 1 WIDE ANGLE TV CAMERA WAS IDENTICAL TO THOSE CARRIED ON ALL PREVIOUS MISSIONS. HOWEVER, THIS FLIGHT CARRIED TWO IDENTICAL CAMERAS MOUNTED DIAMETRICALLY OPPOSITE TO EACH OTHER AND CANTED 2L DEG AWAY FROM THE PLANE OF ROTATION OF THE SPACECRAFT; THIS IS THE TIROS 9 CARTWHEEL CONFIGURATION. EACH CAMERA IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN VIEWING THE EARTH, ONCE EACH SPACECRAFT ROTATION (10 RPM). EACH CAMERA CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TV-TYPE ELECTRONIC SIGNALS, WHICH CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR LATER TRANSMISSION. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SECS. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. TRANSMISSION OF THE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A FREQUENCY OF 235 MHZ.</p>									
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
5 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.4 TO 0.65 MICRON NA		
38. FIELD OF VIEW	39. GROUND SWATH	
74.0 BY 74.0 DEG 650 NM BY 650 NM FROM 400 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.2 DEG 1.4 NM PER TV LINE FROM 400 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	RED CIRCULAR	SUN-SYNCH RETROGRADE
47. COMPONENTS		
TV CAMERA, TRANSMITTER, TAPE RECORDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. INTERFERENCE
		58. SHIELDING
		59. DATA RECOVERY
		60. DATA RECOVERY
		61. FREQUENCY OF OBSERVATION
NO IN-FLIGHT CALIBRATION DELAYED TELEMETRY		
62. TELEMETRY REQUIREMENTS		
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT A FREQUENCY OF 235 MHZ.		
63. ADVANTAGES AND LIMITATIONS		
BROAD SYNOPTIC VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM RED OR NARROW ANGLE CAMERAS.		
64. REFERENCES		
<p>1) SIGNIFICANT ACHIEVEMENTS IN SAT NET 1958-1964. NASA SP-96.***</p> <p>2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***</p> <p>4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966. ***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.</p>		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

ESSA 2

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM (TITLE CONT.)		APT							
4. RESUME DATE		5. VERSION		6. DATE					
11/10/69		0006							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
O'BRIEN, J.J. (T.MON)		GODDARD SPACE FLT CENTER		301-982-5716					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. STATUS					
				POST FLIGHT					
15. MONITOR		16. AGENCY		17. TELEPHONE					
GLOVER, J.C.		NESC/ESSA							
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		02/66 NA					
26. INSTRUMENT TYPE		27. RECORD		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
IMAGER, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON		UNC		ESSA 2					
31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. S/N OF 30 DB AT 0.7 FOOT CANDLES/SEC; 10 LEVELS OF GRAY	
THIS SYSTEM, CONSISTING OF 2-IDENTICAL 1-INCH VIDICON APT CAMERAS, WAS ALSO TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 AND OPERATIONALLY FLOWN ON ESSA 4 AND 6. EACH CAMERA UTILIZES A TELE-KINOPTIC, 108-DEGREE, WIDE ANGLE, F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE TWO CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS, SO THEY POINT DIRECTLY DOWNWARD ONCE EVERY 5.5 SECS, DURING WHICH TIME PICTURES ARE TAKEN. THE SYSTEM IS PROGRAMMED TO TAKE AND TRANSMIT A PICTURE EVERY 350 SECS, FOR A TOTAL SEQUENCE OF 8 PICTURES, WHILE THE SATELLITE IS IN DAYLIGHT. THE ACTUAL PICTURE TAKING REQUIRES 8 SECS AND THE TRANSMISSION FOUR LINES PER SECOND, AND THE SIGNALS TRANSMITTED PRODUCING AN CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH TRACK. THE SHUTTER UTILIZED IS A MODIFIED TIROS TYPE-F, FULL-SCAN, FOCAL-PLANE SHUTTER ADJUSTED FOR A 1.5-MSEC EXPOSURE. TWO 5-WATT TV TRANSMITTERS ARE USED, EACH PROVIDING A 137.5 MHZ CARRIER. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A RECORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE.		CLOUD AND TERRAIN FEATURES OF APPROX 2 NM OR LARGER		DYNAMIC PICTURE RANGE OF 25:1		S/N OF 30 DB AT 0.7 FOOT CANDLES/SEC; 10 LEVELS OF GRAY			
36. INSTRUMENT RANGE		37. MEASUREMENT RANGE		38. PRECISION AND ACCURACY		39. S/N OF 30 DB AT 0.7 FOOT CANDLES/SEC; 10 LEVELS OF GRAY			

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO 0.65 MICRON NA					
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG 1800 NM BY 1800 NM FROM 750 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.132 DEG 1.7 NM FROM 750 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		SON-SYNCH RETROGRADE	
47. COMPONENTS					
2 VIDICON CAMERAS, 2 ELECTRONICS MODULES, 2 FM TRANSMITTERS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
22 LB		28 WATTS		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE	
SENSITIVE/SENSITIVE		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. SHIELDING		59. SHIELDING	
60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS	
REALTIME TELEMETRY		CONTINUOUS DAYTIME			
THE VIDEO OUTPUT, TURN-ON, AND PHASING CODE DRIVE A MODULATOR WHICH AMPLITUDE MODULATES THE 2400 HZ SUBCARRIER, THUS REQUIRING 4000 HZ MAXIMUM FREQUENCY CAPABILITY.					
63. ADVANTAGES AND LIMITATIONS					
DIRECT TRANSMISSION TO MANY GROUND STATIONS WITHOUT INTERMEDIATE STORAGE ON MAGNETIC TAPE.					
64. REFERENCES					
1) APT USERS GUIDE. ESSA, NAT WEATHER SAT CTR, 1965.***2) SPANPPL, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS. NASA/GSPC TN D-1915, NOV. 1963.***3) FINAL ENGINEERING REPORT, TOS/OT-2. RCA CORP. MAY 1967.***4) SIG ACHIEV IN SPACE APP. 1966 NASA-SP-156.***5) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET. GSPC, 1968.					
65. HISTORICAL REMARKS					
SIMILAR TO APT ON TIROS 8, NIMBUS 1 AND 2, AND ESSA 4 AND 6.					
66. DIAGRAMS					

ESSA 3

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
ADVANCED VIDICON CAMERA SYSTEM				AVCS					
(TITLE CONT.)				4. RESUME					
				5. VERSION					
				11/10/69 0005					
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION			8. TELEPHONE					
O'PRIEN, J.J. (T.MON)	GODDARD SPACE FLT CENTER			301-982-5716					
9. CO-INVESTIGATOR	10. ORGANIZATION			11. TELEPHONE					
12. CONTRACT TYPE				13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS	18. POST FLIGHT
19. MONITOR	19. AGENCY		20. GSM OFFICE		21. TELEPHONE				
GLOVER, J.C.	NESC (ESSA)								
22. VENDOR	23. LOCATION		24. FLIGHT DATE		25. LEAD TIME				
RCA ASTRO-ELECTRONICS	PRINCETON, N.J.		10/66 NA						
26. INSTRUMENT TYPE				27. SECURITY					
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON				UNC					
28. APPLICATION				29. SPACECRAFT					
HET, ERSP				ESSA 3					
30. PURPOSE									
PRIMARY-TO PROVIDE METEOROLOGICAL DATA IN THE FORM OF WIDE-ANGLE HIGH-RESOLUTION TELEVISION PICTURES OF EARTH'S CLOUD COVER, BY TRANSMITTING PRERECORDED TV PICTURES TO CDA STATIONS.***SECOND-ARY-MAINTAIN OPERATIONAL CAPABILITY OF THE AVCS.									
31. PRINCIPLES OF OPERATION THE AVCS, TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3 AND 5, ARE SIMILAR EXCEPT FOR DIFFERENT CAMERA LENSES AND ESSA HAVING 2 CAMERAS WHILE NIMBUS HAD 3. THE ESSA SYSTEM CONSISTS OF 2 IDENTICAL 1-INCH VIDICONS HAVING 800 TV LINE RESOLUTION. THE CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACE-CRAFT AND PERPENDICULAR TO THE SPIN AXIS. DURING PICTURE TAKING SEQUENCE THE CAMERA LOOKS AT THE NADIR. THE LENS IS A TEGA KIN-OPIC 108 DEGREE WIDE ANGLE LENS WITH A FOCAL LENGTH OF 5.7 MM AND AN ELECTROMAGNETICALLY CONTROLLED SHUTTER. THE CAMERA CON-VERTS THE OPTICAL IMAGE TO AN ELECTRICAL SIGNAL WHICH IS PRO-CESSED AND RECORDED ON A MAGNETIC TAPE RECORDER. THE VIDICON HAS AN INHERENT STORAGE PROPERTY WHICH PERMITS A NOMINAL 6.5 SECOND FRAME TIME. CONCURRENTLY WITH SHUTTER ACTUATION, A 16-INCRE-MENT GRAY SCALE IS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. THE CAMERA IS INDEPENDENTLY TRIGGERED INTO OPERATION ONLY WHEN IT COMES IN VIEW OF THE EARTH; THIS IS DONE BY A HORIZON CROSSING INDICATOR(HCI), ONE FOR EACH CAMERA. THE CAMERA CAN TAKE 6 OR 12 CLOUD COVER PICTURES PER ORBIT AT 260-SECOND INTERVALS WITH A 50 PERCENT OVERLAP.									
32. PHENOMENA OBSERVED CLOUD COVER OF EARTH (REFLECTED VISIBLE SOLAR RADIATION)									
33. MEASUREMENT RANGE DYNAMIC RANGE OF 14 TO 11,400 FOOT-LAMBERTS									
34. PRECISION AND ACCURACY 800 TV-LINE RESOLUTION; 16 LEVELS OF GRAY									

35. SPECTRAL RANGE	0.45 TO 0.65 MICRON	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	89.0 BY 89.0 DEG 1700 NM BY 1700 NM FROM 750 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	42. POINTING ACCURACY	43. POINTING RATE
0.11 DEG 1.4 NM PER TV-LINE AT THE NADIR FROM 750 NM ALT		44. ALTITUDE	45. INCLINATION
0.5 DEG		46. SPECIAL REQUIREMENTS	
47. COMPONENTS			
2 TV CAMERA SYSTEMS, 2 TAPE RECORDERS, SYSTEM ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
43 LB		16 WATT	
52. THERMAL	53. SHIELDING	54. INTERFERENCE	55. INTERFERENCE
		56. DATA RECOVERY	57. INTERFERENCE
58. CALIBRATION	59. SENSITIVE	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
GRAY-SCALE CALIBRATION	DELAYED TELEMETRY		
62. TELEMETRY REQUIREMENTS			
RECORDER IS PLAYED BACK ON CDA STATION COMMAND VIA THE SPACE-CRAFT 235-MHZ TRANSMITTER. TRANSMISSION TIME FOR A FULL ORBIT OF PICTURES IS APPROXIMATELY 3 MINUTES.			
63. ADVANTAGES AND LIMITATIONS			
DUE TO CAMERA MOUNTING PICTURES ARE TAKEN STRAIGHT DOWN MINIMIZ-ING DISTORTION AND INCREASING ACCURACY			
64. REFERENCES			
1) FINAL ENGINEERING REPORT TOS A-VOL 1,2,3-RCA ASTRO-ELECTRONICS CONTRACT NO. NAS 5-9034, MAY 5, 1967.***2) SIG ACHIEV IN SPACE APP 1966. NASA SP-156, 1967.***3) OSTROM, H.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOP. FOR METEOROLOGY. NASA/GSFC, AUG. 1968.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, N.C.			
65. HISTORICAL REMARKS			
SIMILAR TO AVCS ON NIMBUS 1 AND 2, AND ESSA 5.			
66. DIAGRAMS			

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
<b>LOW-RESOLUTION INFRARED RADIOMETER</b> (TITLE CONT.)						<b>LRIR</b> 4. NAME DATE		5. VERSION 0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
<b>PARENT, DR. R. J.</b>		<b>UNIVERSITY OF WISCONSIN</b>		<b>608-262-5938</b>					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
								17. STATUS	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. POST FLIGHT	
<b>GLOVER, J. C.</b>		<b>NESC/ESSA</b>		<b>301-440-7543</b>					
23. VENDOR		24. LOCATION		25. LEAD TIME					
<b>UNIVERSITY OF WISCONSIN</b>		<b>MADISON, WISCONSIN</b>		<b>10/66</b>					
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT			
<b>RADIOMETER, FLAT-PLATE IR/VISIBLE LOW-RESOLUTION</b>				<b>ESSA 3</b>					
30. PURPOSE		<b>NET</b>							
PRIMARY-TO GATHER DATA TO AID IN DETERMINING: (1) THE GEOGRAPHIC DISTRIBUTION OF ENERGY RADIATED FROM THE EARTH AND THE RELATIONSHIP OF THIS ENERGY TO INCOMING ENERGY FROM THE SUN AND (2) THE REFLECTION AND SCATTERING OF SOLAR RADIATION BY THE EARTH-ATMOSPHERE SYSTEM.									
31. PRINCIPLES OF OPERATION THE ESSA FLAT PLATE RADIOMETER SYSTEM, IS DIVIDED INTO 2 BASIC COMPONENTS: A FLAT PLATE RADIOMETER WITH A 180 DEG FOV, AND A FLAT PLATE RADIOMETER EMPLOYING A CONE SHIELD TO MINIMIZE OR REMOVE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION (70 DEG FOV). THE HEART OF EACH SENSOR IS A THIN ALUMINUM DISK THERMALLY AND RADIATIVELY ISOLATED FROM ITS MOUNTS. THE DISK TEMPERATURE IS SENSED BY 2 THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISK. THE HOUSING TEMPERATURES AND THE CONE TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. TWO SPECTRAL RESPONSES ARE PROVIDED FOR THE DISKS BY THE USE OF ANODIZED ALUMINUM OR BLACK PAINT. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RERADIATED LONG WAVE RADIATION. THE ANODIZED ALUMINUM SENSOR DISKS REFLECT IN THE VISIBLE RANGE BUT ABSORB IR RADIATION IN THE 7 TO 30 MICRON RANGE. THESE RESPOND TO THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. BOTH DISK TYPES ARE USED WITH BOTH RADIOMETERS SO THAT 4 RADIOMETERS ARE NEEDED TO COMPLETE A SRT. TWO SUCH SETS ARE MOUNTED 180 DEG APART ON THE S/C BUT ISOLATED THERMALLY AND RADIATIVELY FROM IT.									
32. PHENOMENA OBSERVED									
<b>ENERGY RADIATED FROM AND REFLECTED BY THE EARTH/ATMOSPHERE</b>									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.3 TO 30.0 MICRONS					
38. FIELD OF VIEW		39. GROUND SWATH			
SEE ITEM 31		LIMB-TO-LIMB (4200 NM) FROM 750 NM ALTITUDE			
40. ANGULAR RESOLUTION: 41. SPATIAL RESOLUTION					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		SUN-SYNCH RETROGRADE	
47. COMPONENTS					
8 SENSORS (THERMISTORS), ELECTRONICS, RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
				57. INTERFERENCE	
				58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
				62. TELEMETRY REQUIREMENTS	
				90 KBITS TAPE CAPACITY.	
63. ADVANTAGES AND LIMITATIONS					
THE PPR DID NOT GET GOOD DATA STARTS HENCE TIME ERRORS OCCUR IN MOST READOUTS.					
64. REFERENCES					
1) FINAL ENGINEERING REPORT TOS A MET SAT SYSTEM, VOL 1. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, MAY 5, 1967.***2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 68.***3) ESSA NEWS RELEASE NO. ES 66-54, SEPT 19, 1968.***4) DATA AVAILABLE FROM NESC, ESSA, WASH. D.C.					
65. HISTORICAL REMARKS					
THIS RADIOMETER WILL ALSO FLY ON ITOS A, B, C, AND D.					
66. DIAGRAMS					



ESSA 4

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM (TITLE CONT.)		APT DATE		5. VERSION					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		11/10/69 10006			
O'BRIEN, J. J. (T.MO)		GODDARD SPACE FLT CENTER		301-982-5716					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		17. STATUS	
GLOVER, J. C.		NESC/ESSA		301-440-7543				POST FLIGHT	
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		27. SECURITY	
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		01/67 NA				UNC	
26. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT					
IMAGER, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON		ESSA 4							
30. PURPOSE									
PRIMABY-TO PROVIDE METEOROLOGISTS WITH REALTIME INFORMATION ON CLOUD AND WEATHER CONDITIONS OVER A LARGE AREA AROUND THE RECEIVING STATION.***SECONDARY-MAINTAIN CAPABILITY OF THE TOS-ESSA SATELLITE SYSTEM.									
31. PRINCIPLES OF OPERATION									
THIS SYSTEM, CONSISTING OF TWO IDENTICAL 1-INCH VIDICON APT CAMERAS, WAS ALSO TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 AND OPERATIONALLY FLOWN ON ESSA 2 AND 6. EACH CAMERA UTILIZES A TE-GEA-KINOPTIC, 108-DEGREE, WIDE-ANGLE, F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7MM. THE TWO CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS, SO THEY POINT DIRECTLY DOWNWARD ONCE EVERY 5.5 SECS, DURING WHICH TIME PICTURES ARE TAKEN. THE SYSTEM IS PROGRAMMED TO TAKE AND TRANSMIT A PICTURE EVERY 350 SECS FOR A TOTAL OF 8 PICTURES, WHILE THE SATELLITE IS IN DAYLIGHT. THE ACTUAL PICTURE TAKING REQUIRES 8 SECS AND THE TRANSMISSION 200 SECS. DURING THIS LATTER PERIOD THE VIDICON IS SCANNED AT FOUR LINES PER SECOND, AND THE SIGNALS TRANSMITTED PRODUCING AN 800-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. THE SHUTTER UTILIZED IS A MODIFIED TIROS TYPE-F, FULL-SCAN, FOCAL-PLANE SHUTTER ADJUSTED FOR A 1.5-MSEC EXPOSURE. TWO 5-WATT TV TRANSMITTERS ARE USED, EACH PROVIDING A 137.5-MHZ CARRIER. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A REORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE.									
32. PHENOMENA OBSERVED									
CLOUD AND TERRAIN FEATURES OF APPROX 2 NM OR LARGER									
33. MEASUREMENT RANGE									
DYNAMIC PICTURE RANGE 25:1									
34. PRECISION AND ACCURACY									
S/N OF 30 DB AT 0.7 FOOT-CANDLES/SEC; 10 LEVELS OF GRAY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO		0.65 MICRON NA			
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG		1800 NM BY 1800 NM FROM 750 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.132 DEG		1.7 NM FROM 750 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		SUN-SYNCH RETROGRADE	
47. COMPONENTS					
2 VIDICON CAMERAS, 2 ELECTRONICS MODULES, 2 FM TRANSMITTERS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
55 LB				51. STANDBY POWER	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
55.1B		28 WATTS		57. SHIELDING	
56. INTERFERENCE		57. INTERFERENCE		58. SHIELDING	
57. INTERFERENCE		58. INTERFERENCE		59. SHIELDING	
58. INTERFERENCE		59. INTERFERENCE		60. DATA RECOVERY	
59. INTERFERENCE		60. INTERFERENCE		61. FREQUENCY OF OBSERVATION	
60. INTERFERENCE		61. INTERFERENCE		62. TELEMETRY REQUIREMENTS	
61. INTERFERENCE		62. INTERFERENCE		63. ADVANTAGES AND LIMITATIONS	
62. INTERFERENCE		63. INTERFERENCE		64. REFERENCES	
63. INTERFERENCE		64. INTERFERENCE		65. HISTORICAL REMARKS	
64. INTERFERENCE		65. INTERFERENCE		66. DIAGRAMS	
THE VIDEO OUTPUT, TURN-ON, AND PHASING CODE DRIVE A MODULATOR WHICH AMPLITUDE MODULATES THE 2400 HZ SUBCARRIER, THUS REQUIRING 4000 HZ MAXIMUM FREQUENCY CAPABILITY.					
DIRECT TRANSMISSION TO MANY GROUND STATIONS WITHOUT INTERMEDIATE STORAGE ON MAGNETIC TAPE.					
1) APT USERS GUIDE. ESSA, NAT WEATHER SAT CTR, 1965.***2) STAMPPL, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR NET SATS. NASA/GSPC TN D-1915, NOV. 1963.***3) FINAL ENGINEERING REPORT, TOS/OT-2. RCA CORP. MAY 1967.***4) SIG ACHIEV IN SPACE APP. 1966 NASA SP-156.***5) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR NET. GSPC, 1968.					
SIMILAR TO APT ON TIROS 8, NIMBUS 1 AND 2, AND ESSA 2 AND 6.					

ESSA 5

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
ADVANCED VIDICON CAMERA SYSTEM (TITLE CONT.)	AVCS								
4. PROJECT DATE	5. VERSION								
11/10/69	0005								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
O'BRIEN, J.J. (T.HON)	GODDARD SPACE FLT CENTER		301-982-5716						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. START DATE	15. COMPLETION DATE	16. STATUS					
				POST FLIGHT					
18. MONITOR	19. AGENCY		20. PGM OFFICE		21. TELEPHONE				
GLOVER, J.C.	NESC/ESSA				301-440-7543				
22. VENDOR	23. LOCATION		24. DATE		25. LEAD TIME				
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY		04/67		NA				
26. INSTRUMENT TYPE	27. SECURITY								
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON	UNC								
28. APPLICATION	29. SPACECRAFT								
EXT. FBSP	ESSA 5								
30. PURPOSE									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE AVCS, TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3 AND 5, ARE SIMILAR EXCEPT FOR DIFFERENT CAMERA LENSES AND ESSA HAVING 2 CAMERAS WHILE NIMBUS HAD 3. THE ESSA SYSTEM CONSISTS OF 2 IDENTICAL 1-INCH VIDICONS HAVING 800 TV LINE RESOLUTION. THE CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS. DURING PICTURE TAKING SEQUENCE THE CAMERA LOOKS AT THE NADIR. THE LENS IS A TEGA KIN-OPTIC 108 DEGREE WIDE ANGLE LENS WITH A FOCAL LENGTH OF 5.7 MM AND AN ELECTROMAGNETICALLY CONTROLLED SHUTTER. THE CAMERA CONTROLS THE OPTICAL IMAGE TO AN ELECTRICAL SIGNAL WHICH IS PROCESSED AND RECORDED ON A MAGNETIC TAPE RECORDER. THE VIDICON HAS AN INHERENT STORAGE PROPERTY WHICH PERMITS A NOMINAL 6.5 SECOND FRAME TIME. CONCURRENTLY WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE IS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. THE CAMERA IS INDEPENDENTLY TRIGGERED INTO OPERATION ONLY WHEN IT COMES IN VIEW OF THE EARTH; THIS IS DONE BY A HORIZON CROSSING INDICATOR (HCI), ONE FOR EACH CAMERA. THE TRACK MAGNETIC TAPE RECORDER CAN STORE UP TO 36 PICTURES. EACH CAMERA CAN TAKE 6 OR 12 CLOUD COVER PICTURES PER ORBIT AT 260-SECOND INTERVALS WITH A 50 PERCENT OVERLAP.</p> <p>32. PHENOMENA OBSERVED</p> <p>CLOUD COVER OF EARTH (REFLECTED VISIBLE SOLAR RADIATION)</p> <p>33. MEASUREMENT RANGE</p> <p>DYNAMIC RANGE OF 14 TO 11400 FOOT-LAMBERTS</p> <p>34. PRECISION AND ACCURACY</p> <p>800 TV-LINE RESOLUTION; 16 LEVELS OF GRAY</p>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.45 TO 0.65 MICRON NA		40.0 MILLISEC
38. FIELD OF VIEW	39. GROUND SWATH	
89.0 BY 89.0 DEG 1700 NM BY 1700 NM FROM 750 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.11 DEG 1.4 NM PER TV-LINE AT CENTER FROM 750 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
0.5 DEG		45. INCLINATION
46. SPECIAL REQUIREMENTS	47. COMPONENTS	
	2 TV CAMERA SYSTEMS, 2 TAPE RECORDERS, SYSTEM ELECTRONICS	
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
43 LB		16 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
GRAY-SCALE CALIBRATION	DELAYED TELEMETRY	DAYSIDE OF ORBIT
57. TELEMETRY REQUIREMENTS		
58. ADVANTAGES AND LIMITATIONS		
59. REFERENCES		
1) FINAL ENGINEERING REPORT TOS A, VOL 1, 2, 3, RCA ASTRO-ELECTRONICS CONTRACT NO. NAS 5-9034, MAY 5, 1967.***2) SIG ACHIEV IN SPACE APP 1966. NASA SP-156, 1967.***3) OSTROW, H.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOP. FOR METEOROLOGY. NASA/GSPC, AUG. 1968.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, N.C.		
60. HISTORICAL REMARKS		
SIMILAR TO AVCS ON NIMBUS 1 AND 2, AND ESSA 3.		
61. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LOW-RESOLUTION INFRARED RADIOMETER (TITLE CONT.)	LRIR								
4. RESUME	5. VERSION								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
PARENT, DR. R.J.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. DATE	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT					
GLOVER, J.C.	NESC/ESSA		301-440-7543						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	08/67							
26. INSTRUMENT TYPE	27. REMARKS								
RADIOMETER, FLAT-PLATE IR/VISIBLE LOW-RESOLUTION	UNC								
28. APPLICATION	29. SPACECRAFT								
ART	ESSA 5								
30. PURPOSE									
PRIMARY-TO GATHER DATA TO AID IN DETERMINING: (1) THE GEOGRAPHIC DISTRIBUTION OF ENERGY RADIATED FROM THE EARTH AND THE RELATIONSHIP OF THIS ENERGY TO INCOMING ENERGY FROM THE SUN AND (2) THE REFLECTION AND SCATTERING OF SOLAR RADIATION BY THE EARTH-ATMOSPHERE SYSTEM.									
31. PRINCIPLES OF OPERATION									
<p>THE ESSA FLAT PLATE RADIOMETER SYSTEM, IS DIVIDED INTO 2 BASIC COMPONENTS: A FLAT PLATE RADIOMETER WITH A 180 DEG FOV, AND A FLAT PLATE RADIOMETER EMPLOYING A CONE SHIELD TO MINIMIZE OR REMOVE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION (70 DEG FOV). THE HEART OF EACH SENSOR IS A THIN ALUMINUM DISK THERMALLY AND RADIATIVELY ISOLATED FROM ITS MOUNTS. THE DISK SURFACE IS SENSED BY 2 THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISK. THE HOUSING TEMPERATURES AND THE CONE TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. TWO SPECTRAL RESPONSES ARE PROVIDED FOR THE DISKS BY THE USE OF ANODIZED ALUMINUM OR BLACK PAINT. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RERADIATED LONG WAVE RADIATION. THE ANODIZED ALUMINUM SENSOR DISKS REFLECT IN THE VISIBLE RANGE BUT ABSORB IR RADIATION IN THE 7 TO 30 MICRON RANGE. THESE RESPOND TO THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. BOTH DISK TYPES ARE USED WITH BOTH RADIOMETERS SO THAT 4 RADIOMETERS ARE NEEDED TO COMPLETE A SET. TWO SUCH SETS ARE MOUNTED 180 DEG APART ON THE S/C BUT ISOLATED THERMALLY AND RADIATIVELY FROM IT.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH/ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 30.0 MICRONS		
38. FIELD OF VIEW	39. GROUND SWATH	
SPE ITEM 31	LIMB-TO-LIMB (4200 NM) FROM 750 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	RED CIRCULAR SUN-SYNCH RETROGRADE	
47. COMPONENTS		
8 SENSORS (THERMISTORS), ELECTRONICS, RECORDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. NUCLEAR
		57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY	60. SENSITIVE FOR THERMALLY ISOLATED
		61. FREQUENCY OF OBSERVATION
62. TELEMETRY REQUIREMENTS	DELATED TELEMETRY	
90 KBITS TAPE CAPACITY.		
63. ADVANTAGES AND LIMITATIONS		
THE PPR DID NOT GET GOOD DATA STARTS. THUS TIME ERRORS WERE INCURRED IN MOST READOUTS.		
64. REFERENCES		
<p>1) FINAL ENGINEERING REPORT TOS A NET SAT SYSTEM, VOL 1, RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, MAY 5, 1967.***2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 68.***3) ESSA NEWS RELEASE NO. ES 66-54, SEPT 19, 1968.***4) DATA AVAILABLE FROM NESC, ESSA, WASH. D.C.</p>		
65. HISTORICAL REMARKS		
THIS RADIOMETER WILL ALSO FLY ON ITOS A, B, C, AND D.		
66. DIAGRAMS		

ESSA 6

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM		APT		4. RESUME		5. VERSION			
(TITLE CONT.)		11/10/69		0005					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
O'BRIEN, J.J. (T.MO)		GODDARD SPACE FLT CENTER		301-982-5716					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
GLOVER, J.C.		NESC/ESSA		301-440-7543				OPERATIONAL	
23. VENDOR		24. LOCATION		25. LEAD TIME		26. DATE		27. SECURITY	
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		11/67		NA		UNC	
28. INSTRUMENT TYPE		29. APPLICATION		30. SPACECRAFT		31. ESSA 6			
IMAGER, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON									
32. PURPOSE		33. APPLICATION		34. SPACECRAFT		35. ESSA 6			
PRIMARY-TO PROVIDE METEOROLOGISTS WITH REALTIME INFORMATION ON CLOUD AND WEATHER CONDITIONS OVER A LARGE AREA AROUND THE RECEIVING STATION.***SECONDARY-MAINTAIN CAPABILITY OF THE TOS-ESSA SATELLITE SYSTEM.									
36. PRINCIPLES OF OPERATION		37. DESCRIPTION OF OPERATION		38. DESCRIPTION OF OPERATION		39. DESCRIPTION OF OPERATION		40. DESCRIPTION OF OPERATION	
THIS SYSTEM, CONSISTING OF TWO IDENTICAL 1-INCH VIDICON APT CAMERAS, WAS ALSO TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 AND OPERATIONALLY FLOWN ON ESSA 2 AND 4. EACH CAMERA UTILIZES A TEGEAKINOPTIC, 108-DEGREE, WIDE-ANGLE, F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE TWO CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS, SO THEY POINT DIRECTLY DOWNWARD ONCE EVERY 5.5 SECS DURING WHICH TIME PICTURES ARE TAKEN. THE SYSTEM IS PROGRAMMED TO TAKE AND TRANSMIT A PICTURE EVERY 350 SECS FOR A TOTAL OF 8 PICTURES, WHILE THE SATELLITE IS IN DAYLIGHT. THE ACTUAL PICTURE TAKING REQUIRES 8 SECS AND THE TRANSMISSION 200 SECS. DURING THIS LATTER PERIOD THE VIDICON IS SCANNED AT FOUR LINES PER SECOND, AND THE SIGNALS TRANSMITTED PRODUCING AN 800-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. THE SHUTTER UTILIZED IS A MODIFIED TIROS TYPE-P, FULL SCAN, FOCAL-PLANE SHUTTER ADJUSTED FOR A 1.5-HSEC EXPOSURE. TWO 5-WATT TV TRANSMITTERS ARE USED, EACH PROVIDING A 137.5-MHZ CARRIER. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A REORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE.									
41. PHENOMENA OBSERVED		42. PHENOMENA OBSERVED		43. PHENOMENA OBSERVED		44. PHENOMENA OBSERVED		45. PHENOMENA OBSERVED	
CLOUD AND TERRAIN FEATURES OF APPROXIMATELY 2 NM OR LARGER									
46. MEASUREMENT RANGE		47. MEASUREMENT RANGE		48. MEASUREMENT RANGE		49. MEASUREMENT RANGE		50. MEASUREMENT RANGE	
DYNAMIC PICTURE RANGE OF 25:1									
51. PRECISION AND ACCURACY		52. PRECISION AND ACCURACY		53. PRECISION AND ACCURACY		54. PRECISION AND ACCURACY		55. PRECISION AND ACCURACY	
S/N OF 30 DB AT 0.7 FOOT CANDLES/SEC; 10 LEVELS OF GRAY									

35. SPECTRAL RANGE	0.45 TO 0.65 MICRON NA	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	89.0 BY 89.0 DEG 1800 NM BY 1800 NM FROM 750 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	42. POINTING ACCURACY	43. POINTING RATE
0.132 DEG 1.7 NM FROM 750 NM ALTITUDE		44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
2 VIDICON CAMERAS, 2 ELECTRONICS MODULES, 2 FM TRANSMITTERS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
55 LB		28 WATTS	40 WATTS
52. INTERFERENCE	53. MAGNETIC INTERFERENCE	54. NUCLEAR INTERFERENCE	55. SHIELDING
SENSITIVE SENSITIVE			MAGNETIC SHIELDING USED
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	59. REALTIME TELEMETRY
			CONTINUOUS DAYTIME
60. TELEMETRY REQUIREMENTS			
THE VIDEO OUTPUT, TURN-ON, AND PHASING CODE DRIVE A MODULATOR WHICH AMPLITUDE MODULATES THE 2400 HZ SUBCARRIER, THUS REQUIRING 4000 HZ MAXIMUM FREQUENCY CAPABILITY.			
61. ADVANTAGES AND LIMITATIONS			
DIRECT TRANSMISSION TO MANY GROUND STATIONS WITHOUT INTERMEDIATE STORAGE ON MAGNETIC TAPE.			
62. REFERENCES			
1) APT USERS GUIDE ESSA, NAT WEATHER SAT CTR, 1965.***2) STAMPPI, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS. NASA/GSPC TN D-1915, NOV. 1963.***3) FINAL ENGINEERING REPORT, TOS/OT-2. RCA CORP. MAY 1967.***4) SIG ACHIEV IN SPACE APP. 1966 NASA SP-156.***5) OSTROM, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET. GSPC, 1968.			
63. HISTORICAL REMARKS			
SIMILAR TO APT ON TIROS 8, NIMBUS 1 AND 2, AND ESSA 2 AND 4.			
64. DIAGRAMS			

ESSA 7



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. NAME		5. VERSION	
ADVANCED VIDICON CAMERA SYSTEM (TITLE CONT.)		AVCS		11/10/69 0004		11/10/69 0004		11/10/69 0004	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. TELEPHONE		10. ORGANIZATION	
O'BRIEN, J.J. (T.HON)		GODDARD SPACE PLT CENTER		301-982-5716		301-982-5716		301-982-5716	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		12. TELEPHONE		13. TELEPHONE	
12. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. DATE		17. STATUS	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. LOCATION	
GLOVER, J.C.		NESC/ESSA		301-440-7543		301-440-7543		301-440-7543	
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		26. LEAD TIME	
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		08/68		08/68		08/68	
28. INSTRUMENT TYPE		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED	
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON		ESSA 7		ESSA 7		ESSA 7		ESSA 7	
HET, ERSP		ESSA 7		ESSA 7		ESSA 7		ESSA 7	
<p>PRIMARY-TO PROVIDE METEOROLOGICAL DATA IN THE FORM OF WIDE-ANGLE HIGH-RESOLUTION TELEVISION PICTURES OF EARTH'S CLOUD COVER BY TRANSMITTING PRERECORDED TV PICTURES TO CDA STATIONS.***</p> <p>SECONDARY-TO MAINTAIN OPERATIONAL CAPABILITY OF THE AVCS.</p>									
<p>THE AVCS, ON THIS AND THE ESSA 9 SPACECRAFT WAS TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3 AND 5. ALL ARE SIMILAR EXCEPT FOR DIFFERENT CAMERA LENSES. THE ESSA/TOS SPACECRAFT HAVE 2 CAMERAS WHILE NIMBUS HAD 3. THE ESSA/TOS SYSTEM CONSISTS OF 2 IDENTICAL 1-INCH VIDICONS HAVING 833 TV LINE RESOLUTION. THE CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS. DURING PICTURE-TAKING SEQUENCE THE CAMERA LOOKS AT THE NADIR. THE LENS IS A TEGEA-KINOPTIC 108-DEGREE WIDE-ANGLE LENS WITH A FOCAL LENGTH OF 6.0 MM AND AN ELECTROMAGNETICALLY CONTROLLED SHUTTER. THE CAMERA CONVERTS THE OPTICAL IMAGE TO AN ELECTRICAL SIGNAL WHICH IS PROCESSED AND RECORDED ON MAGNETIC TAPE RECORDER. THE VIDICON HAS AN INHERENT STORAGE PROPERTY WHICH PERMITS A NOMINAL 6.5 SECOND FRAME-SCAN TIME. CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE IS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. THE CAMERA IS INDEPENDENTLY TRIGGERED INTO OPERATION ONLY WHEN IT COMES INTO VIEW OF THE EARTH. THE 4 TRACK MAGNETIC TAPE RECORDER CAN STORE UP TO 36 PICTURES. EACH CAMERA CAN TAKE 6 OR 12 CLOUD COVER PICTURES PER ORBIT AT 260-SECOND INTERVALS WITH A 50 PERCENT OVERLAP.</p>									
CLOUD COVER OF EARTH (REFLECTED VISIBLE SOLAR RADIATION)									
DYNAMIC RANGE OF 14 TO 11,400 FOOT LAMBERTS									
PRECISION AND ACCURACY									
833-LINE RESOLUTION, 16 LEVELS OF GRAY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO 0.65 MICRONS NA		39. GROUND SWATH		40. HILL SEC	
89.0 BY 89.0 DEG 1700 NM BY 1700 NM FROM 750 NM ALTITUDE.		41. SPATIAL RESOLUTION		42. POINTING RATE	
0.17 DEG 1.5 NM PER TV LINE AT CENTER FROM 750 NM ALTITUDE		44. ALTITUDE		45. INCLINATION	
0.5 DEG		MED CIRCULAR		SDN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
2 TV CAMERA SYSTEMS, 2 TAPE RECORDERS, SYSTEM ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
43 LB		16 WATTS		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. SHIELDING	
55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
GRAY SCALE CALIBRATION		DELAYED TELEMETRY		MAGNETIC SHIELDING	
61. TELEMETRY REQUIREMENTS					
RECORDER IS PLAYED BACK ON CDA STATION COMMAND VIA THE SPACE-CRAFT 235 MHZ TRANSMITTER. TRANSMISSION TIME FOR A FULL ORBIT OF PICTURES IS APPROX 3 MINUTES.					
62. ADVANTAGES AND LIMITATIONS					
CAMERA MOUNTING ALLOWS PICTURES TO BE TAKEN STRAIGHT DOWN, MINIMIZING DISTORTION AND INCREASING ACCURACY.					
63. REFERENCES					
1) FINAL ENGINEERING REPORT TOS A, VOL 1, 2, 3. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS 5-9034, MAY 5, 1967.***2) SIG ACHIEV IN SPACE APP 1966. NASA SP-156, 1967.***3) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY. NASA/GSFC, AUG. 1968.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR JESSAL, ASHEVILLE, N.C.					
64. HISTORICAL REMARKS					
TEST FLOWN ON NIMBUS 1 AND 2: OPERATIONAL ON ESSA 3, 5, AND 9.					
65. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
LOW-RESOLUTION INFRARED RADIOMETER		LIR		11/10/69		0005			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
PARENT, DR. R.J.		UNIVERSITY OF WISCONSIN		608-262-5938					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. POST FLIGHT	
GLOVER, J.C.		NESC/ESSA		301-440-7543					
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
UNIVERSITY OF WISCONSIN		MADISON, WISCONSIN		08/68					
26. INSTRUMENT TYPE		27. APPLICATION		28. SPACECRAFT		29. SECURITY		30. UNCL	
RADIOMETER, FLAT-PLATE IR/VISIBLE LOW-RESOLUTION		ESSA 7							
31. PRINCIPLES OF OPERATION									
<p>THE ESSA FLAT PLATE RADIOMETER SYSTEM, IS DIVIDED INTO 2 BASIC COMPONENTS: A FLAT PLATE RADIOMETER WITH A 180 DEG FOV, AND A FLAT PLATE RADIOMETER EMPLOYING A CONE SHIELD TO MINIMIZE OR REMOVE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION (70 DEG FOV). THE HEART OF EACH SENSOR IS A THIN ALUMINUM DISK THERMALLY AND RADIATIVELY ISOLATED FROM ITS MOUNTS. THE DISK TEMPERATURE IS SENSED BY 2 THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISK. THE HOUSING TEMPERATURES AND THE CONE TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. TWO SPECTRAL RESPONSES ARE PROVIDED FOR THE DISKS BY THE USE OF ANODIZED ALUMINUM OR BLACK PAINT. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RADIATED LONG WAVE RADIATION. THE ANODIZED ALUMINUM SENSOR DISKS REFLECT IN THE VISIBLE RANGE BUT ABSORB IR RADIATION IN THE 7 TO 30 MICRON RANGE. THESE RESPOND TO THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. BOTH DISK TYPES ARE USED WITH BOTH RADIOMETERS SO THAT 4 RADIOMETERS ARE NEEDED TO COMPLETE A SET. TWO SUCH SETS ARE MOUNTED 180 DEG APART ON THE S/C BUT ISOLATED THERMALLY AND RADIATIVELY FROM IT.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH/ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.3 TO 30.0 MICRONS					
38. FIELD OF VIEW		39. GROUND SWATH			
SEE ITEM 31		LIMB-TO-LIMB (4200 NM) FROM 750 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		RED CIRCULAR		SUN-SYNCH RETROGRADE	
47. COMPONENTS					
8 SENSORS (THERMISTORS), ELECTRONICS, RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCF		56. INTERFERENCE	
57. NUCLEAR		58. SHIELDING			
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
				62. TELEMETRY REQUIREMENTS	
				90 KBITS TAPE CAPACITY.	
63. ADVANTAGES AND LIMITATIONS					
THE PPR DID NOT GET GOOD DATA STARTS. THUS TIME ERRORS WERE INCURRED IN MOST READINGS.					
64. REFERENCES					
1) FINAL ENGINEERING REPORT TOS A MET SAT SYSTEM, VOL 1. RCA ASTRO-ELECTRONICS, CONTRACT NO. NA55-9034, MAY 5, 1967.***2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 68.***3) ESSA NEWS RELEASE NO. ES 66-54, SEPT 19, 1968.***4) DATA AVAILABLE FROM NESC, ESSA, WASH. D.C. 65. HISTORICAL REMARKS THIS RADIOMETER WILL ALSO FLY ON ITOS A, B, C, AND D. 66. DIAGRAMS					

ESSA 8

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM (TITLE CONT.)		APT		4. NAME		5. VARIATION			
		11/10/59		0005					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
O'BRIEN, J.J. (T.HON)		GODDARD SPACE FLT CENTER		301-982-5716					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
								17. STATUS	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. FLT MODEL	
GLOVER, J.C.		NESC/ESSA				301-480-7543			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
BCA ASTRO-ELECTRONICS		PRINCETON, N.J.		12/68					
26. INSTRUMENT TYPE		27. SECURITY							
IMAGER, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON									
28. APPLICATION		29. SPACECRAFT		ESSA 8					
30. PURPOSE									
<p>PRIMARY- TO PROVIDE REALTIME CLOUD COVER PICTURES OVER A LARGE AREA AROUND ANY SUITABLY EQUIPPED RECEIVING STATION. ***</p> <p>SECONDARY- TO MAINTAIN CAPABILITY OF THE TOS-ESSA SATELLITE SYSTEM.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS SYSTEM, NOW WELL-USED, CONSISTING OF TWO IDENTICAL 1-INCH VIDICON APT CAMERAS, WAS ALSO TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 AND OPERATIONALLY FLOWN ON ESSA 2, 4, AND 6. EACH CAMERA UTILIZES A TEGA-KINOPTIC, 108-DEG WIDE-ANGLE, F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE 2 CAMERAS ARE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS, SO THEY POINT DIRECTLY DOWNWARD ONCE EVERY 5.5 SECS, DURING WHICH TIME PICTURES ARE TAKEN. THE SYSTEM IS PROGRAMMED TO TAKE AND TRANSMIT A PICTURE EVERY 350 SECS FOR A TOTAL OF 8 PICTURES, WHILE THE SATELLITE IS IN DAYLIGHT. THE ACTUAL PICTURE TAKING REQUIRES 8 SECS AND THE TRANSMISSION 200 SECS. DURING THIS LATTER PERIOD THE VIDICON IS SCANNED AT FOUR LINES PER SECOND, AND THE SIGNALS TRANSMITTED PRODUCING AN 800-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. THE SHUTTER UTILIZED IS A MODIFIED TIROS TYPE-F, FULL-SCAN, FOCAL-PLANE SHUTTER, ADJUSTED FOR A 1.5 MILSEC EXPOSURE. TWO 5-WATT TV TRANSMITTERS ARE USED, EACH PROVIDING A 137.5-MHZ CARRIER. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A RECORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE.</p> <p>32. PHENOMENA OBSERVED</p> <p>CLOUD AND TERRAIN FEATURES OF APPROX 2 MM OR LARGER</p> <p>33. MEASUREMENT RANGE</p> <p>DYNAMIC PICTURE RANGE 25:1</p> <p>34. PRECISION AND ACCURACY</p> <p>S/N OF 30 DB AT 0.7 FOOT-CANDLES/SEC; 10 LEVELS OF GRAY</p>									

35. SPECTRAL RANGE		0.45 TO 0.65 MICRON NA		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
38. FIELD OF VIEW		89.0 BY 89.0 DEG 1800 NM BY 1800 NM FROM 750 NM ALTITUDE		39. GROUND SWATH			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION		42. POINTING RATE		43. INCLINATION	
0.132 DEG 1.7 NM FROM 740 NM ALTITUDE				44. ALTITUDE		45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		SUN-SYNCH RETROGRADE			
47. COMPONENTS							
2 VIDICON CAMERAS, 2 ELECTRONICS MODULES, 2 PM TRANSMITTERS							
48. WEIGHT		49. VOLUME		50. AVERAGE POWER		51. STANDBY POWER	
55 LB		28 WATTS		52. PEAK POWER		53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
SENSITIVE		NUCLEAR		58. SHIELDING		59. SHIELDING	
60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS	
REALTIME TELEMETRY		CONTINUOUS DAYTIME		64. REFERENCES		65. HISTORICAL REMARKS	
<p>THE VIDEO OUTPUT, TURN-ON, AND PHASING CODE DRIVE A MODULATOR WHICH AMPLITUDE MODULATES THE 2400 HZ SUBCARRIER, THUS REQUIRING 4000 HZ MAXIMUM FREQUENCY CAPABILITY.</p> <p>DIRECT TRANSMISSION TO MANY GROUND STATIONS WITHOUT INTERMEDIATE STORAGE ON MAGNETIC TAPE. 2 CAMERAS INSURE LONG OPERATING PERIOD.</p> <p>1) APT USERS GUIDE. ESSA, NAT WEATHER SAT CTR, 1965.***2) STAMPFL, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS. NASA/GSFC TN D-1915, NOV. 1963.***3) FINAL ENGINEERING REPORT, TOS/OT-2, RCA CORP. MAY 1967.***4) SIG ACHIEV IN SPACE APP, 1966. NASA SP-156.***5) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET. GSFC, 1968.</p> <p>66. DIAGRAMS</p> <p>FLOWN ON TIROS 8, NIMBUS 1 AND 2, AND ESSA 2, 4 AND 6.</p>							

ESSA 9

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
ADVANCED VIDICON CAMERA SYSTEM	AVCS								
(TITLE CONT.)	4. RESUME		5. VERSION						
	11/10/69		0004						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
O'BRIEN, J.J. (J.MON)	GODDARD SPACE FLT CENTER		301-982-5716						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMM. DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GLOVER, J.C.	NESC/ESSA		301-440-7543						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, N.J.	02/69							
26. INSTRUMENT TYPE	1/4. RESUME								
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON	UNC								
28. APPLICATION	29. SPACECRAFT								
HET, ERSP	ESSA 9								
30. PURPOSE									
31. PRINCIPLES OF OPERATION									
<p>PRIMARY-TO PROVIDE METEOROLOGICAL DATA IN THE FORM OF WIDE-ANGLE HIGH-RESOLUTION TELEVISION PICTURES OF EARTH'S CLOUD COVER; BY TRANSMITTING PRE-RECORDED TV PICTURES TO CDA STATIONS. *** SECONDARY- TO MAINTAIN OPERATIONAL CAPABILITY OF THE AVCS</p> <p>THE AVCS, NOW A WELL-USED INSTRUMENT, WAS TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3, 5 AND 7. ALL ARE SIMILAR EXCEPT FOR DIFFERENT CAMERA LENSES. THE ESSA/TOS SPACECRAFT HAVE 2 CAMERAS WHILE NIMBUS HAD 3. THE ESSA/TOS SYSTEM CONSISTS OF 2 IDENTICAL 1-INCH VIDICONS HAVING 833-TV-LINE RESOLUTION. THE CAMERAS ARE MOUNTED 180 DEGREES APART ON THE SIDE OF THE SPACECRAFT AND PERPENDICULAR TO THE SPIN AXIS. DURING PICTURE TAKING SEQUENCE THE CAMERA LOOKS AT THE NAIR. THE LENS IS A TELEGA-KINOPTIC 108-DEGREE WIDE-ANGLE LENS WITH A FOCAL LENGTH OF 6.0 MM AND AN ELECTROMAGNETICALLY CONTROLLED SHUTTER. THE CAMERA CONVERTS THE OPTICAL IMAGE TO AN ELECTRICAL SIGNAL WHICH IS PROCESSED AND RECORDED ON A MAGNETIC TAPE RECORDER. THE VIDICON HAS AN INHERENT STORAGE PROPERTY WHICH PERMITS A NOMINAL 6.5 SECOND FRAME SCAN TIME. CONCURRENT WITH SHUTTER ACTUATION A 16-INCREMENT GRAY SCALE IS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. THE CAMERA IS INDEPENDENTLY TRIGGERED INTO OPERATION ONLY WHEN IT COMES IN VIEW OF THE EARTH. THE 4 TRACK MAGNETIC TAPE RECORDER CAN STORE UP TO 36 PICTURES. EACH CAMERA CAN TAKE 6 OR 12 CLOUD COVER PICTURES PER ORBIT AT 260-SECOND INTERVALS WITH A 50 PERCENT OVERLAP.</p> <p>32. PHENOMENA OBSERVED</p> <p>CLOUD COVER OF EARTH (REFLECTED VISIBLE SOLAR RADIATION)</p> <p>33. MEASUREMENT RANGE</p> <p>DYNAMIC RANGE OF 14 TO 11,400 FOOT-LAMBERTS</p> <p>34. PRECISION AND ACCURACY</p> <p>833-LINE RESOLUTION, 16 LEVELS OF GRAY</p>									

36. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO 0.65 MICRON NA				40. MILLISEC	
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG 1700 NM BY 1700 NM FROM 750 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.17 DEG 1.5 NM PER TV LINE AT CENTER FROM 750 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		45. INCLINATION	
0.5 DEG		MD CIRCULAR		SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
2 TV CAMERA SYSTEMS, 2 TAPE RECORDERS, SYSTEM ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
43 LB		16 WATTS		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE	
55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. INTERFERENCE		59. INTERFERENCE		60. DATA RECOVERY	
61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS	
GRAY-SCALE CALIBRATION		DELAYED TELEMETRY		DAYSIDE OF ORBIT	
RECORDER IS PLAYED BACK ON CDA STATION COMMAND VIA THE SPACE-CRAFT 235-MHZ TRANSMITTER. TRANSMISSION TIME FOR A FULL ORBIT OF PICTURES IS APPROX 3 MINUTES.					
CAMERA MOUNTING ALLOWS PICTURES TO BE TAKEN STRAIGHT DOWN, MINIMIZING DISTORTION AND INCREASING ACCURACY.					
84. REFERENCES					
1) FINAL ENGINEERING REPORT TOS A, VOL. 1, 2, 3. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS 5-9034, MAY 5, 1967. **2) SIG ACHIEV IN SPACE APP 1966. NASA SP-156, 1967. ***3) OSTROW, H. AND WEINSTEIN O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY. NASA/GSPC, AUG. 1968. ***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, N.C.					
65. HISTORICAL REMARKS					
FLOON ON NIMBUS 1, 2 AND ESSA 3, 5 AND 7.					
86. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LOW-RESOLUTION INFRARED RADIOMETER	LRIR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
PARENT, DR. R.J.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GLOVER, J.C.	NESC/ESSA		301-440-7543						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	02/69							
26. INSTRUMENT TYPE									
RADIOMETER, PLAT-PLATE IR/VISIBLE LOW-RESOLUTION									
28. APPLICATION	29. SPACECRAFT								
RET	ESSA 9								
30. PURPOSE									
PRIMARY-TO GATHER DATA TO AID IN DETERMINING: (1) THE GEOGRAPHIC DISTRIBUTION OF ENERGY RADIATED FROM THE EARTH AND THE RELATIONSHIP OF THIS ENERGY TO INCOMING ENERGY FROM THE SUN AND (2) THE REFLECTION AND SCATTERING OF SOLAR RADIATION BY THE EARTH-ATMOSPHERE SYSTEM.									
31. PRINCIPLES OF OPERATION									
<p>THE ESSA PLAT PLATE RADIOMETER SYSTEM, IS DIVIDED INTO 2 BASIC COMPONENTS: A PLAT PLATE RADIOMETER WITH A 180 DEG FOV, AND A PLAT PLATE RADIOMETER EMPLOYING A CONE SHIELD TO MINIMIZE OR REMOVE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION (70 DEG FOV). THE HEART-OF EACH SENSOR IS A THIN ALUMINUM DISK THERMALLY AND RADIATIVELY ISOLATED FROM ITS MOUNTS. THE DISK TEMPERATURE IS SENSED BY 2 THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISK. THE HOUSING TEMPERATURES AND THE CONE TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. TWO SPECTRAL RESPONSES ARE PROVIDED FOR THE DISKS BY THE USE OF ANODIZED ALUMINUM OR BLACK PAINT. THE BLACK-PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RERADIATED LONG WAVE RADIATION. THE ANODIZED ALUMINUM SENSOR DISKS REFLECT IN THE VISIBLE RANGE BUT ABSORB IR RADIATION IN THE 7 TO 30 MICRON RANGE. THESE RESPONSES TO THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. BOTH DISK TYPES ARE USED WITH BOTH RADIOMETERS SO THAT 4 RADIOMETERS ARE NEEDED TO COMPLETE A SET. TWO SUCH SETS ARE MOUNTED 180 DEG APART ON THE S/C BUT ISOLATED THERMALLY AND RADIATIVELY FROM IT.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH/ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 30.0 MICRONS		
38. FIELD OF VIEW	39. GROUND SWATH	
SEE ITEM 31	40. LIMB-TO-LIMB (4200 NM) FROM 750 NM ALTITUDE	
41. SPATIAL RESOLUTION	42. ANGULAR RESOLUTION	
43. POINTING RATE	44. ALTITUDE	45. INCLINATION
	MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS		
47. COMPONENTS		
8 SENSORS (THERMISTORS), ELECTRONICS, RECORDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
53. MTBF		
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. SHIELDING
		58. SENSITIVE FPR THERMALLY ISOLATED
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
	DELAYED TELEMETRY	CONTINUOUS
62. TELEMETRY REQUIREMENTS		
90 KBITS TAPE CAPACITY.		
63. ADVANTAGES AND LIMITATIONS		
THE FPR DID NOT GET GOOD DATA STARTS. THUS TIME ERRORS WERE INCURRED IN MOST READOUTS.		
64. REFERENCES		
<p>1) FINAL ENGINEERING REPORT TOS A MET SAT SYSTEM, VOL 1. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, MAY 5, 1967.***2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 68.***3) ESSA NEWS RELEASE NO. ES 66-54, SEPT 19, 1968.***4) DATA AVAILABLE FROM NESC, ESSA, WASH. D.C.</p>		
65. HISTORICAL REMARKS		
THIS RADIOMETER WILL ALSO FLY ON ITOS-A, B, C, AND D.		
66. DIAGRAMS		

EXPLORER 7



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER (TITLE CONT.)	LROR								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SHUMI, DR. V. E.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT					
HOLTZ, J. R.	NASA RDOTES	OSSA/SG	202-962-3825						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	10/59	NA						
26. INSTRUMENT TYPE									
RADIOMETER, IR OMNIDIRECTIONAL NON-SCANNING LOW-RESOLUTION									
28. APPLICATION	29. SPACECRAFT								
MET	EXPLORER 7								
30. PURPOSE									
PRIMARY-TO MEASURE THE GROSS HEAT BUDGET OF THE EARTH.*** SECONDARY-TO DETERMINE HOW MUCH SOLAR ENERGY IS ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE.									
31. PRINCIPLES OF OPERATION									
EXPERIMENTS SIMILAR TO THIS WERE ALSO FLOWN ON TIROS 3, 4, AND 7. ON EXPLORER 7, THREE RADIATION CURRENTS ARE MEASURED WITH SIMPLE BOLOMETERS IN THE FORM OF HOLLOW SILVER HEMISPHERES. THE HEMI- SPHERES ARE THERMALLY ISOLATED FROM, BUT IN CLOSE PROXIMITY TO SPECIALLY ALUMINIZED MIRRORS. THESE MIRROR BACKED BOLOMETERS ARE MOUNTED ON THE EQUATOR OF THE SATELLITE. THE BOLOMETER'S TEMPERA- TURE IS MEASURED BY A GLASS COATED BEAD THERMISTOR MOUNTED ON THE HEMISPHERE. ALSO, PROVISION IS MADE TO MEASURE THE TEMPERA- TURE OF THE MIRRORS. TWO OF THE HEMISPHERES HAVE A BLACK COATING AND RESPOND ABOUT EQUALLY TO SOLAR AND TERRESTRIAL RADIATION. A THIRD HEMISPHERE, WHITE, IS MORE SENSITIVE TO TERRESTRIAL RADIA- TION THAN TO SOLAR RADIATION. A FOURTH WITH A GOLD METAL SURFACE IS MORE SENSITIVE TO SOLAR RADIATION THAN TO TERRESTRIAL RADIA- TION. A BLACK SPHERE, ON THE AXIS OF THE SATELLITE AT THE TOP, IS USED TO DETERMINE ANY DETERIORATION IN THE MIRROR SURFACES BY COMPARISON WITH BLACKENED HEMISPHERES. A SMALL TABOR-SURFACED HEMISPHERE, PROTECTED FROM DIRECT SUNLIGHT CAN BE USED TO MEAS- SURE REFLECTED SUNLIGHT WHEN THE AXIS OF THE SATELLITE POINTS TO THE EARTH'S SURFACE. THE RADIATION CURRENTS ARE OBTAINED BY USING THESE TEMPERATURES IN HEAT BALANCE EQUATIONS.									
32. PHENOMENA OBSERVED									
SOLAR AND TERRESTRIAL RADIATION									
33. MEASUREMENT RANGE									
128 DEG K TO 488 DEG K									
34. PRECISION AND ACCURACY									
0.1 KELVIN DEGREE									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 60.0 MICRON NA		5. SECONDS
38. FIELD OF VIEW	39. GROUND SWATH	
180.0 DEG	300 NM RADIUS CIRCLE FROM 375 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	MED ECCENTRIC HIGH
45. SPECIAL REQUIREMENTS	46. POSIGRADE	
47. COMPONENTS		
5. MIRROR-BACKED BOLOMETERS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
3 LB		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. MICROWAVE INTERFERENCE	56. SHIELDING
		57. INTERFERENCE
58. DATA RECOVERY	59. SENSITIVE MIRRORS	60. SHIELD SENSORS
		61. FREQUENCY OF OBSERVATION
		REALTIME TELEMETRY
62. TELEMETRY REQUIREMENTS	CONTINUOUS	
DATA SENT ON THE 730 HZ SUBCARRIER IN THE FORM OF A TEN-BIT NATURAL BINARY-CODED WORD. BANDWIDTH USED FOR TRANSMISSION IS 10 HZ.		
63. ADVANTAGES AND LIMITATIONS		
NO DATA STORAGE, DATA LIMITED TO TIME WHEN SATELLITE IN VIEW OF RECEIVING STATION.		
64. REFERENCES		
1) JUNO 2 SUMMARY PROJECT REPORT, VOL 1. EXPLORER 7 SAT. NASA TECH NOTE D-608, JULY 1961.***2) TELEMETRY CODE AND CALIBRATIONS FOR SATELLITE 1959 IOTA (EXPLORER 7). NASA TECH NOTE D-484, MAY 1960.***3) DATA AVAILABLE FROM NASA/NATIONAL SPACE SCIENCE DATA CENTER.***4) FINAL SCIENTIFIC REPORT ON CONTRACT NASW-65. DEPT. OF METEOROLOGY, UNIV. OF WISCONSIN, DEC. 1968.		
65. HISTORICAL REMARKS		
AN EARLY VERSION OF A RADIOMETER USED ON TIROS AND ESSA S/C.		
66. DIAGRAMS		

GEOS 2

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
<b>C-BAND PASSIVE REFLECTOR</b>									
(TITLE CONT.)									
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION								
STANLEY, H. R.	NASA WALLOPS STATION								
8. CO-INVESTIGATOR	10. ORGANIZATION								
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY			20. ROOM OFFICE		21. TELEPHONE			
ROSENBERG, J.D.	NASA HDQTRS			OSSA/SCG		202-963-3361			
22. VENDOR	23. LOCATION			24. FLIGHT DATE		25. LEAD TIME			
				01/68 NA					
26. INSTRUMENT TYPE									
REFLECTOR, C-BAND PASSIVE									
28. APPLICATION									
GEOD									
30. PURPOSE									
GEOS 2									
PRIMARY-TO ALLOW A MORE PRECISE CALIBRATION OF THE TRANSPONDER INTERNAL TIME DELAY; USED IN CONJUNCTION WITH THE C-BAND TRANSPONDER.***SECONDARY-TO PROVIDE PASSIVE C-BAND TRACKING CAPABILITIES.									
31. PRINCIPLES OF OPERATION									
THIS PASSIVE C-BAND REFLECTOR IS INCLUDED ON THE SPACECRAFT IN ORDER TO DETERMINE ACCURATELY THE LONG-TERM EFFECTS OF COMPONENTS AGING AND THE EFFECTS OF RADIATION UPON THE C-BAND TRANSPONDER SYSTEM. BY TRACKING THE SATELLITE WITH BOTH ACTIVE AND PASSIVE SYSTEMS DURING THE SAME PASS, THE CORRECTIONS TO THE ACTIVE SYSTEM MAY BE ACCURATELY DETERMINED. THE SYSTEM WILL ALSO PERMIT C-BAND TRACKING OF THE SATELLITE ON FREQUENCIES OTHER THAN THE TRANSPONDER INTERROGATE FREQUENCY THUS ENABLING GREATER TRACKING COVERAGE WITHOUT ADDITIONAL DRAIN FROM THE SPACECRAFT POWER SYSTEM.									
32. PHENOMENA OBSERVED									
RF (C-BAND) TRANSMISSIONS FROM GROUND STATIONS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
30 DB POINT IS 35 DEG FROM MAIN-BEAM DIRECTION									

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		37. TIME CONSTANT	
NA		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED ECCENTRIC HIGH	
45. SPECIAL REQUIREMENTS		46. INCLINATION		RETROGRADE	
47. COMPONENTS					
C-BAND PASSIVE REFLECTOR					
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER	52. PEAK POWER	53. MTBF
		NONE	NONE	NONE	12 MON
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. INTERFERENCE	58. SHIELDING	
NONP	NONP	NONP	NONP	NONP	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		NA		AS PROGRAMMED	
62. TELEMETRY REQUIREMENTS					
NA					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) NASA PRESS KIT FOR GEOS-2. RELEASE NO: 68-2K, JAN 7, 69.***2) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. REPORT NO. R-4035-45-2. COMMUNICATIONS AND SYSTEMS, INC. OCT 1967.***3) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. REPORT NO. R-4035-50-2. COMMUNICATIONS AND SYSTEMS, INC. JAN 1968.					
65. HISTORICAL REMARKS					
GEOS 2 IS ALSO KNOWN AS EXPLORER 36					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
C-BAND TRANSPONDER (TITLE CONT.)	CTRAN								
4. RESUME	5. VERSION								
	11/10/69		0003						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
STANLEY, R. R.	NASA WALLOPS STATION								
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
ROSENBERG, J. D.	NASA HDOTRS	OSSM/SCG	202-963-3361						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
VEGA PRECISION LABS	VIENNA, VA.	01/68	NA						
26. INSTRUMENT TYPE	27. SECURITY								
TRANSPONDER, 2 C-BAND VEGA MODEL 313 C	UNC								
28. APPLICATION	29. SPACECRAFT								
GEOD	GEOS 2								
30. PURPOSE									
PRIMARY-TO BE USED FOR RANGE RADAR CALIBRATION AND DATA RECORDING FOR EXPERIMENTATION TO DETERMINE THE ACCURACY OF THE RADAR SYSTEM FOR GEOMETRIC AND GRAVIMETRIC GEODESY INVESTIGATIONS. USED IN CONJUNCTION WITH THE C-BAND PASSIVE REFLECTOR EXPERIMENT.									
31. PRINCIPLES OF OPERATION	THIS SYSTEM CONSISTS OF A PAIR OF REDUNDANT C-BAND TRANSPONDERS (VEGA MODEL 313C). THE TRANSPONDERS ARE IDENTICAL EXCEPT FOR INTERNAL DELAY TIME, 5 MICROSEC VS 0.7 MICROSEC WHICH ALLOWS TRANSPONDER IDENTIFICATION. EACH TRANSPONDER HAS ITS OWN CAVITY MOUNTED HELICAL ANTENNA. THE INTERROGATION FREQUENCY IS 5690 MHZ AND THE TRANSMITTER FREQUENCY (DOWNLINK) IS 5765 MHZ. THE TRANSPONDER RECEIVES A PAIR OF PULSES 8 MICROSECONDS APART FROM A GROUND STATION. EIGHT MICROSECONDS AFTER RECEIVING THE FIRST OF THESE PULSES AN INTERNAL GATING PULSE IS GENERATED. WHEN THIS GATING PULSE IS PRESENT, THE SECOND GROUND PULSE WILL GENERATE A RETURN PULSE AFTER A FIXED 4 OR 5 MICROSECOND DELAY (DEPENDENT UPON WHICH OF THE TWO TRANSPONDERS IS IN OPERATION). RANGING IS OBTAINED AT THE GROUND VIA THE TIME REQUIRED TO MAKE THE ROUND TRIP LESS THE FIXED DELAY IN THE SPACECRAFT. THE SYSTEM RECEIVES POWER FROM THE TRANSPONDER BATTERY AND MUST TIME-SHARE THE AVAILABLE POWER WITH THE GRABR AND SECOR TRANSPONDERS. IN ORDER TO DETERMINE ACCURATELY THE LONG-TERM EFFECTS OF AGING AND RADIATION UPON THE TRANSPONDER SYSTEM, DATA IS COMPARED WITH THAT RETURNED FROM THE PASSIVE C-BAND REFLECTOR ALSO ON-BOARD.								
32. PHENOMENA OBSERVED									
RP TRANSMISSION FROM GROUND STATIONS AT 5690 MHZ									
33. MEASUREMENT RANGE									
RANGE GREATER THAN 4000 NM									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
SEE ITEM 31		NA			
38. FIELD OF VIEW		39. GROUND SWATH			
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION					
NA		NA		44. ALTITUDE	
42. POINTING ACCURACY		43. POINTING RATE		45. INCLINATION	
NA		NA		MED ECCENTRIC HIGH	
46. SPECIAL REQUIREMENTS		RETROGRADE			
47. COMPONENTS					
2 VEGA MODEL 313C TRANSPONDERS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
8 LB				51. STANDBY POWER	
54. INTERFERENCE		55. MAGNETIC INTERFERENCE		56. THERMAL INTERFERENCE	
SOURCE		NONE		57. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
NONE		NA		20-40 MIN PER DAY	
62. TELEMETRY REQUIREMENTS					
SEE ITEM 31					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68. ***2) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. REPORT NO. R-4035-50-2, COMMUNICATIONS AND SYSTEMS, INC. JAN 68. ***3) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. REPORT NO. R-4035-45-2, COMMUNICATIONS SYSTEMS, INC. OCT, 67.					
65. HISTORICAL REMARKS					
GEOS 2 IS ALSO KNOWN AS EXPLORER 36					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
DOPPLER BEACON	DBEAC								
(TITLE CONT.)	4. RESUME		5. V4 MOD.						
	11/10/69		0003						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION			8. TELEPHONE					
ANDERLE, R.J.	NAVAL WEAPONS LABORATORY								
9. CO-INVESTIGATOR	10. ORGANIZATION			11. TELEPHONE					
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COM. DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
ROSENBERG, J. D.	NASA HDQTRS	OSSA/SCG	202-963-3361						
22. VENDOR	23. LOCATION	24. DOWNT	25. LEAD TIME						
		01/68	NA						
26. INSTRUMENT TYPE	27. RADIO-FREQUENCY TRANSMITTER								
BEACON, 3									
28. APPLICATION	29. SPACECRAFT								
GEOD	GEOS 2								
30. PURPOSE									
<p>PRIMARY TO REFINE KNOWLEDGE OF THE STRUCTURE OF THE EARTH'S GRAVITATIONAL FIELD.***SECONDARY-TO DETERMINE MORE ACCURATELY THE PRECISE POSITIONS OF THE U S NAVY TRINET GROUND STATIONS RELATIVE TO THE CENTER OF THE MASS OF THE EARTH.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS DOPPLER TRANSMITTER WAS PLOWN ON GEOS-1 AND ALSO HAS BEEN USED FOR GEODETIC RESEARCH IN EARLY NAVY SATELLITES, IN THE ANNA-1B AND IN THE NASA EXPLORER 27 SATELLITE. THE SYSTEM CONSISTS OF 3 RADIO-FREQUENCY TRANSMITTERS OPERATING AT 162, 325, AND 972 MHZ, 2 INTERCHANGABLE 5-MHZ STABLE OSCILLATORS, AND MULTIPLYING CIRCUITRY TO PROVIDE STABLE TRANSMITTER FREQUENCIES. THE USE OF 3 COHERENT RADIO FREQUENCIES, GENERATED BY THE MAIN OSCILLATOR, ALLOWS THE COMPUTATION AND CORRECTION OF THE IONOSPHERIC REFRACTION EFFECT ON THE DOPPLER FREQUENCY. THE DOPPLER BEACON ON THE SATELLITE TRANSMITS 250 MILLIWATT AT 162 MHZ, 400 MILLIWATT AT 325 MHZ AND 500 MILLIWATT AT 972 MHZ. THE 162 AND 325 MHZ TRANSMITTERS ARE MODULATED WITH THE TELEMETRY TIME MARKER WHILE THE THIRD TRANSMITTER IS UNMODULATED. THE DOPPLER BEACONS USE THE MAIN POWER SUPPLY OF THE SPACECRAFT AND TRANSMIT CONTINUOUSLY.</p>									
32. PHENOMENA OBSERVED									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
162. TO 972. MHZ	NA	NA
38. FIELD OF VIEW	39. GROUND SWATH	
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION		
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	MED ECCENTRIC HIGH
45. SPECIAL REQUIREMENTS	46. INCLINATION	
	RETROGRADE	
47. COMPONENTS		
3 RF TRANSMITTERS, 2 OSCILLATORS, AND CIRCUITRY		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
11 LB		10 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
SOURCE NONE	NONE	10 WATTS
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
NONE	REALTIME TELEMETRY	CONTINUOUS
62. TELEMETRY REQUIREMENTS		
SEE ITEM 31		
63. ADVANTAGES AND LIMITATIONS		
64. REFERENCES		
1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68.***2) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT, COMMUNICATIONS AND SYSTEMS, INC. REPORT NO. R-4035-45-2, OCT 1967.***3) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. COMMUNICATION AND SYSTEMS, INC. REPORT NO. R-4035-50-2, JAN 1968.		
65. HISTORICAL REMARKS		
ALSO PLOWN ON GEOS 1 AND NAVY SATELLITES. GEOS 2 = EXPLORER 36		
66. DIAGRAMS		

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. VERSION	
LASER DETECTOR		LDEC							
(TITLE CONT.)				11/10/69		0004			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
PLOTKIN, DR. H.H.		GODDARD SPACE FLT CENTER		301-982-4942					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
								17. STATUS	
18. MONITOR		19. AGENCY		20. POM OFFICE		21. TELEPHONE		22. OPERATIONAL	
ROSENBERG, J. D.		NASA HQ/IRS		OSSA/SCG		202-963-3361			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
WASHINGTON TECH. ASSOC.		ROCKVILLE, MARYLAND		01/68		NA			
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
PHOTOMETER, 4880-ANGSTROM CW-LASER PHOTOMULTIPLIER DETECTOR		UNC						GEOS. 2	
PRIMARY-TO DETERMINE WHETHER LASER BEAMS TRANSMITTED TO ORBITING SATELLITES ARRIVE AT THE SATELLITE AT PREDICTED POWER LEVELS.*** SECONDARY-TO DETERMINE THE FREQUENCY AND DEPTH OF MODULATION AND SCINTILLATION OF THE LASER BEAM AS VIEWED FROM THE SATELLITE.									
31. PRINCIPLES OF OPERATION THIS LASER DETECTOR WAS DESIGNED TO DETECT MODULATION OF AN ARGON LASER BEAM (4880 A WAVELENGTH) CHOPPED AT 13 KHZ. THE FIELD OF VIEW OF THE SYSTEM IS 80 DEG. A 0.6 IN (1.5 CM) DIAMETER APERTURE STOP AND A SET OF 2 LENSES THAT FORM A 2.2 IN (5.6 CM) FOCAL LENGTH, F/0.78 OBJECTIVE COLLIMATE THE LIGHT SO THAT THE BEAM STRIKES A WAVELENGTH FILTER WITHIN 8 DEG OF NORMAL. THE FILTER IS 2.70 IN (6.9 CM) IN DIAMETER WITH A PEAK TRANSMISSION OF 50 PERCENT AT 4890 A AND A HALF-POWER BANDWIDTH OF 46 A. TRANSMISSION OUTSIDE THIS PASSBAND IS LESS THAN 0.0063 PER CENT FROM 2500 TO 20000 A. AFTER THE FILTER, ANOTHER SET OF LENSES JUST LIKE THE OBJECTIVE CONDENSES THE LIGHT ONTO A 14 STAGE PHOTOMULTIPLIER TUBE WITH A 1 IN (2.54 CM) DIAMETER BI-ALKALI PHOTOCATHODE (EMR TYPE 541D-01-14). FROM HERE AN OUTPUT SIGNAL GOES INTO AN FET PREAMPLIFIER THEN INTO A PIEZO-ELECTRIC FILTER WITH A 160 HZ BANDPASS CENTERED AT 13 KHZ. THUS THIS DETECTOR IS SENSITIVE ONLY TO MODULATION IN FREQUENCY OF LESS THAN 80 HZ. (THE MODULATIONS ARE EXPECTED TO BE PREDOMINATELY LESS THAN 10 HZ.) AFTER DETECTION A LOG AMPLIFIER COMPRESSES THE SIGNAL RANGE OF 1000 INTO A -5 TO +5 V RANGE FOR TELEMETRY.									
32. PHENOMENA OBSERVED									
CONTINUOUS-WAVE MODULATED ARGON-LASER LIGHT (4880 A)									
33. MEASUREMENT RANGE									
0.1 TO 100 PICONATT									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
4880.		A		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
80.0		DEG 900 NM DIAM CIRCLE FROM 600 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED ECCENTRIC HIGH	
45. SPECIAL REQUIREMENTS		46. SPECIAL REQUIREMENTS		47. COMPONENTS	
PHOTOMULTIPLIER ASSEMBLY		48. WEIGHT		49. VOLUME	
4 LB		0.1 CU FT		2 WATTS	
50. INTERFERENCE		51. MAGNETIC INTERFERENCE		52. THERMAL INTERFERENCE	
NA		NA		NA	
53. CALIBRATION		54. DATA RECOVERY		55. FREQUENCY OF OBSERVATION	
56. DELAYED TELEMETRY		57. 10 MIN PER DAY			
58. TELEMETRY REQUIREMENTS		59. DATA TELEMETRY		60. BANDWIDTH NEEDED=	
DATA TELEMETRY VIA A 136.32-MHZ TRANSMITTER. BANDWIDTH NEEDED=		80 HZ.			
61. ADVANTAGES AND LIMITATIONS		62. REFERENCES		63. HISTORICAL REMARKS	
		1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68.***2) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. REPORT NO. R-4035-50-2. COMMUNICATIONS AND SYSTEMS, INC. JAN 68.***3) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. REPORT NO. R-4035-2. COMMUNICATIONS AND SYSTEMS, INC. OCT, 67.***4) DESIGN AND PERFORMANCE OF GEOS-LASER DETECTOR. TMX-63222, OCT. 67.			
64. GEOS 2 IS ALSO KNOWN AS EXPLORER 36.		65. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
LASER REFLECTOR		LRP							
(TITLE CONT.)		4. DATE		5. VERSION					
		11/10/69		0003					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
PLOTKIN, DR. H.H.		GODDARD SPACE PLT CENTER		301-982-4942					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		17. STATUS	
ROSENBERG, J. D.		NASA HQDTRS		OSSA/SCG		202-963-3361		OPERATIONAL	
22. VENDOR		23. LOCATION		24. FILE NO.		25. DATE		26. LEAD TIME	
GE SPACE TECHNOLOGY CTR		VALLEY FORGE, PA		01/68		NA			
27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION	
REFLECTOR, 400 1-INCH CUBICAL SILVERED-PRISM				GEOS 2				<p>THIS IS AN ARRAY OF QUARTZ CUBIC CORNER REFLECTORS MOUNTED ON 4 OF THE 8 PLAT PANELS ON THE BOTTOM SURFACE OF THE SPACECRAFT. EACH REFLECTOR IS A FUSED QUARTZ PRISM ABOUT ONE INCH IN SIZE WITH SILVERED REFLECTING SURFACES. THERE ARE A TOTAL OF 400 PRISMS ON THE SPACECRAFT, PROVIDING A TOTAL REFLECTING AREA OF 360 SQUARE INCHES. THE PRISMS ARE JOINED TO AN ACCURACY OF 3 ARC-SEC AND REFLECT AT LEAST 50% OF THE INCIDENT BEAM ANTI-PARALLEL WITHIN A 20 ARC-SEC CONE. THE EFFECTIVE USABLE ANGLE OF THE REFLECTORS IS CONTAINED WITHIN A CONE OF 40-DEG HALF-ANGLE FROM THE SATELLITE NADIR. WHEN THE SATELLITE IS WITHIN RANGE, THESE QUARTZ CUBES REFLECT BACK TO THE SOURCE THE HIGH-ENERGY SHORT-DURATION PULSES FIRED BY THE GROUND LOCATED LASER TRACKING SYSTEMS. THE REFLECTED LIGHT IS PICKED UP BY A TELESCOPE AND THEN A DIGITAL COUNTER MEASURES THE ROUND-TRIP TRAVEL TIME OF THE LIGHT PULSES. THIS GIVES THE DISTANCE TO THE SATELLITE AND THUS FORMS THE BASIS OF THE SATELLITE OPTICAL LASER TRACKING SYSTEM. PHOTOGRAPHING THE REFLECTION AGAINST THE STAR FIELD YIELDS ANGULAR POSITION.</p>	
32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. RANGE MEASUREMENT		36. RANGE-RATE MEASUREMENT	
HIGH-ENERGY SHORT-DURATION LASER PULSES FROM GROUND STATIONS						TO ABOUT 1 CM/SEC			

35. SPECTRAL RANGE	0.45 TO 0.7 MICRON	36. SPECTRAL RESOLUTION	NA	37. TIME CONSTANT	
38. FIELD OF VIEW	80.0 DEG	39. GROUND SWATH	900 NM DIAM CIRCLE FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION (M4)	DEG 3.5 NM FROM 600 NM ALTITUDE	41. SPATIAL RESOLUTION	MPD ECCENTRIC HIGH	42. ALTITUDE	RETROGRADE
43. POINTING RATE		44. ALTITUDE		45. INCLINATION	
46. SPECIAL REQUIREMENTS		47. COMPONENTS		48. WEIGHT	
49. PRISMS		50. AVERAGE POWER	NONE	51. STANDBY POWER	NONE
52. INTERFERENCE	NONE	53. INTERFERENCE	NONE	54. INTERFERENCE	NONE
55. CALIBRATION	NONE	56. DATA RECOVERY	NONE	57. FREQUENCY OF OBSERVATION	AS SCHEDULED
58. TELEMETRY REQUIREMENTS		59. ADVANTAGES AND LIMITATIONS		60. REFERENCES	
61. HISTORICAL REMARKS	1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68. ***2) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. REPORT NO. R-4035-45-2, COMMUNICATIONS AND SYSTEMS, INC., OCT 67. ***3) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. REPORT NO.: R-4035-50-2, COMMUNICATIONS AND SYSTEMS INC, JAN 68.				
62. DIAGRAMS	ALSO FLOWN ON EXPLORERS 22, 27, AND 29. GEOS 2 = EXPLORER 36.				

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
OPTICAL BEACON	OBZAC								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0003							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
BERBERT, J.H.	GODDARD SPACE FLT CENTER								
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
ROSENBERG, J. D.	NASA HDOTRS	OSSA/SCG	202-963-1361						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
E. G. AND G. INC.	BEDFORD, MASS	01/68	NA						
26. INSTRUMENT TYPE									
BEACON, FOUR HIGH-INTENSITY XENON-FLASH-TUBE									
28. APPLICATION	29. SPACECRAFT								
GEOD	GEOS 2								
30. PURPOSE									
PRIMARY-TO OBTAIN GEOMETRIC TRIANGULATION OF INTERVISIBLE POINTS ON THE EARTH'S SURFACE. ***SECONDARY-TO OBTAIN PRECISE ANGLE MEASUREMENTS.									
31. PRINCIPLES OF OPERATION	<p>THE OPTICAL BEACONS ARE USED IN CONJUNCTION WITH A LARGE NUMBER OF GROUND-BASED CAMERA SYSTEMS WHICH SIMULTANEOUSLY PHOTOGRAPH THE BEACONS AGAINST A STAR BACKGROUND. THE BEACON SYSTEM CONSISTS OF 4 IDENTICAL HELICALLY-WOUND FLASH TUBES FILLED WITH XENON GAS. MAXIMUM LIGHT LEVELS AT GROUND STATIONS OCCUR WHEN THE SATELLITE IS SEEN BETWEEN 35 AND 55 DEG ELEVATION ANGLE. THIS BEACON SYSTEM WITH 4 LAMPS FLASHED SIMULTANEOUSLY IS SUITABLE FOR OPERATIONAL ALTITUDES UP TO 1000 NM. THE LIGHT OUTPUT IS 1580 CANDLE-SECONDS FOR EACH FLASH TUBE OR APPROXIMATELY 6300 CANDLE-SECS FOR ALL 4 TUBES FLASHING SIMULTANEOUSLY. THE NOMINAL FLASH DURATION IS 1 MILLISECOND BETWEEN 30% INTENSITY POINTS. IN TERMS OF POWER, BETWEEN 610 AND 950 INDIVIDUAL LAMP FLASHES PER DAY ARE AVAILABLE. THE ENERGY USED IN A SINGLE FLASH IS 720 WATT-SEC. EACH FLASH TUBE IS EXPECTED TO HAVE A FLASH INTENSITY OF AT LEAST 50% OF ITS INITIAL VALUE AFTER 40,000 FLASHES. THE PROGRAMMED FLASH TIMES AND NUMBER OF TUBES TO BE FLASHED ARE INJECTED INTO THE SATELLITE MEMORY, BY THE ROSMAN GROUND STATION, ON A DAILY BASIS.</p>								
32. PHENOMENA OBSERVED	NA								
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
NA	NA	
38. FIELD OF VIEW	39. GROUND SWATH	
NA	NA	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	45. INCLINATION
46. SPECIAL REQUIREMENTS	MED ECCENTRIC HIGH	RETROGRADE
47. COMPONENTS		
FOUR FLASH TUBES, BATTERY		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
80 LBS		51. STANDBY POWER
		52. PEAK POWER
53. MTBF	54. INTERFERENCE	55. INTERFERENCE
NONE	NONE	56. INTERFERENCE
		57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY	60. FREQUENCY OF OBSERVATION
NONE	NONE	61. FREQUENCY OF OBSERVATION
	NA	62. TELEMETRY REQUIREMENTS
NONE		40 SEQUENCES/DAY
63. ADVANTAGES AND LIMITATIONS		
64. REFERENCES		
1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68.***2) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. REPORT NO: R-4035-50-2, COMMUNICATIONS AND SYSTEMS INC. JAN 68.		
65. HISTORICAL REMARKS		
GEOS 2 IS ALSO KNOWN AS EXPLORER 36.		
66. DIAGRAMS		



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
SATELLITE RANGE AND RANGE-RATE EXPERIMENT	SRARR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0003							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
BERBERT, J. H.	GODDARD SPACE FLT CENTER	301-982-5055							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. STAFF NO.	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
ROSENBERG, J. D.	NASA HDOTRS	OSSA/SCG	202-963-3361						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
GODDARD SPACE FLT CENTER GREENBELT, MD.		01/68	NA						
26. INSTRUMENT TYPE									
TRANSPONDER, S-BAND 2271 MHZ (RECEIVE) AND 1705 MHZ (XMIT)									
28. APPLICATION	29. SPACECRAFT								
GEOD	GEOS 2								
30. PURPOSE									
PRIMARY-TO BE USED FOR TRACKING THE SATELLITE TO AUGMENT GEODETIC DATA.**SECONDARY-TO PROVIDE A COMPARISON OF THIS SYSTEM AND THE OTHER GEODETIC MEASUREMENT INSTRUMENTS ON BOARD.									
31. PRINCIPLES OF OPERATION	<p>THIS SYSTEM PROVIDES MEASUREMENT OF SLANT RANGE AND THE RATE OF CHANGE OF SLANT RANGE OF THE SPACECRAFT. THE RANGE IS OBTAINED BY MEASURING THE PHASE SHIFT OF A WAVE TRAVELLING FROM THE GROUND TRANSMITTER TO THE SATELLITE AND BACK. RANGE RATE IS MEASURED BY DETERMINING THE DOPPLER-SHIFT EFFECT ON SEVERAL MODULATION FREQUENCIES. THE TRANSPONDER RECEIVES SIMULTANEOUS SIGNALS FROM ONE TO THREE GROUND STATIONS AT 2271 MHZ, MODULATED BY THE RANGING SIDETONES. THE TRANSPONDER TRANSLATES THESE SIGNALS INTO THE LOWER CARRIER FREQUENCY (1705 MHZ), WHILE PRESERVING THE COHERENCE OF THE RANGE TONE MODULATION. THE COHERENCE IS PRESERVED BY USING THE SAME OFFSET OSCILLATOR AS A SOURCE FOR THE BASIC FREQUENCY FOR THE DOWN-CARRIER, AND AS A HETERODYNE SOURCE FOR THE UP-CARRIER. NO DEMODULATION OF THE RANGING TONES TAKES PLACE WITH THE UP-CARRIER. THE POWER SUPPLY UNIT IS SHARED WITH THE SECOR AND C-BAND TRANSPONDERS AND CAN SUPPLY POWER TO EACH TRANSPONDER FOR APPROXIMATELY 60 MINUTES PER DAY, ON COMMAND.</p>								
32. PHENOMENA OBSERVED	2271 MHZ (S-BAND) RADIO TRANSMISSIONS FROM GROUND STATIONS								
33. MEASUREMENT RANGE	NA								
34. PRECISION AND ACCURACY	ACCURACY OF RANGE MEASUREMENT IS APPROXIMATELY 10 METERS								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
SEE ITEM 31	NA	
38. FIELD OF VIEW	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	NED ECCENTRIC HIGH
45. SPECIAL REQUIREMENTS		RETROGRADE
47. COMPONENTS		
TRANSPONDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
8 LB		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
SOURC/SEN	MAGNETIC	NUCLEAR
	57. INTERFERENCE	58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
NONE	REALTIME TELEMETRY	30 MIN PER DAY
62. TELEMETRY REQUIREMENTS		
SEE ITEM 31		
63. ADVANTAGES AND LIMITATIONS		
RANGE SIGNAL MARGIN (27 DB AT 900 NM SLANT RANGE) IS SLIGHTLY LOWER THAN SECOR.		
64. REFERENCES		
<p>1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68.***2) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. COMMUNICATIONS AND SYSTEMS, INC, REPORT NO. R-4035-50-2, JAN 68.***3) PLANNED OPERATIONS FOR THE GEOS-B SPACECRAFT. COMMUNICATIONS AND SYSTEMS, INC, REPORT NO. R-4035-45-2, OCT 1967.</p>		
65. HISTORICAL REMARKS		
ALSO FLOWN ON GEOS 1. GEOS 2 IS ALSO KNOWN AS EXPLORER 36.		
66. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. VERSION	
SEQUENTIAL COLLATION OF RANGE SYSTEM		SCOR				4. DATE		5. VERSION	
(TITLE CONT.)						11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
MCALL, J.		CORPS OF ENGINEERS							
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
ROSENBERG, J. D.		NASA HQ/RTS		OSMA/SCG		202-963-3361		OPERATIONAL	
23. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
CUBIC CORPORATION		SAN DIEGO, CAL		01/68		NA			
26. INSTRUMENT TYPE		27. COMMENTS							
TRANSPONDER, RANGING								UNC	
28. APPLICATION		29. SPACECRAFT							
GEOD		GEOS 2							
30. PURPOSE									
PRIMARY-TO DETERMINE POSITIONS BY GEOMETRIC MEANS IN A STEP BY STEP FASHION, AND TO EXTEND A GEOMETRIC SURVEY AROUND THE EARTH.									
31. PRINCIPLES OF OPERATION									
<p>THE RANGE TRANSPONDER PLOW ON GEOS 1, AS WELL AS GEOS 2, IS USED IN CONJUNCTION WITH THE ARMY SECOR (SEQUENTIAL COLLATION OF RANGE) SYSTEM. FOUR GROUND STATIONS INTERROGATE THE SATELLITE IN TURN FOR RANGING TO THE SPACECRAFT TRANSPONDER. RANGE MEASUREMENTS ARE MADE BY MEASURING THE PHASE SHIFT OF THE RANGING SIDETONES WHICH MODULATE THE CW CARRIER. BY USING GEOMETRIC TECHNIQUES THE UNKNOWN POSITION OF 1 OF 4 STATIONS CAN BE ACCURATELY DETERMINED. A SEQUENCE OF 4 INTERROGATIONS, 1 FROM EACH STATION, IS ACCOMPLISHED IN 50 MILLISEC; THESE SEQUENCES CAN BE REPEATED AT A RATE OF 20 A SECOND. IN OPERATION, THE TRANSPONDER RECEIVES AN INTERROGATING SIGNAL (421 MHZ), REMOVES THE FM RANGING FREQUENCIES FROM THE CARRIER AND LOCALLY GENERATES TWO COHERENT REPLY CARRIERS, MODULATING ONE (449 MHZ) WITH ALL THE FM RANGING FREQUENCIES AND THE OTHER (224.5 MHZ) WITH ONLY THE 585.533 KHZ RANGING FREQUENCY. THE SECOND CARRIER ALLOWS A CORRECTION TO BE MADE FOR IONOSPHERIC REFRACTION EFFECTS. THE SECOR TRANSPONDER IS OPERATED FROM A POWER SUPPLY IT SHARES WITH THE SBARR AND C-BAND TRANSPONDERS.</p>									
32. PHENOMENA OBSERVED									
RP TRANSMISSION FROM GROUND STATIONS AT 421 MHZ									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
ACCURACY OF RANGE MEASUREMENT IS APPROXIMATELY 10 METERS									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
SEE ITEM 31		NA			
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED ECCENTRIC HIGH	
45. SPECIAL REQUIREMENTS		46. RETROGRADE			
47. COMPONENTS		48. TRANSPONDER			
49. WEIGHT		50. VOLUME		51. AVERAGE POWER	
11 LB				52. STANDBY POWER	
				53. PEAK POWER	
				54. WATT	
				55. SHIELDING	
56. INTERFERENCE		57. INTERFERENCE		58. INTERFERENCE	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
NONE		REALTIME TELEMETRY		30 MINUTES PER DAY	
62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS			
SEE ITEM 31		LOCATION ERRORS ARE ADDITIVE AS GROUND STATIONS MOVE.			
64. REFERENCES		65. HISTORICAL REMARKS			
1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68.***2) PARAMETRIC ANALYSIS FOR FUTURE GEODETIC SPACECRAFT DEVELOPMENT. COMMUNICATIONS AND SYSTEMS, INC, REPORT NO. R-4035-50-2, JAN 68.***3) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. COMMUNICATIONS AND SYSTEMS, INC, REPORT NO. R-4035-45-2, OCT 1967.		66. DIAGRAMS			
67. GEOS 2 IS ALSO KNOWN AS EXPLORER 36.					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE (TITLE CONT.)	2. ACRONYM	3. EXP NO							
SOLAR-SCIENCE ELECTRON FLUX EXPERIMENT	SSPE								
4. RESUME DATE	5. VERSION								
11/10/69	0005								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
BOSTON, C.O.	APL-JOHNS HOPKINS UNIV	301-776-7100							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
ROSENBERG, J. D.	NASA HDOTRS	OSSA/SCG	207-963-3361						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
APL-JOHNS HOPKINS UNIV	SILVER SPRING, MD.	01/68 NA							
26. INSTRUMENT TYPE									
COUNTER, ELECTRON MULTIPLIER PARTICLE; X-AXIS MAGNETOMETER									
27. JOURNAL									
28. APPLICATION	29. SPACECRAFT								
PART-FLD	GEOS 2								
30. PURPOSE									
PRIMARY-TO MEASURE THE FLUX OF PRECIPITATING ELECTRONS IN THE EARTH'S ATMOSPHERE.									
31. PRINCIPLES OF OPERATION									
<p>THE SOLAR SCIENCE ELECTRON DETECTOR (SSED) IS AN INSTRUMENT TO MEASURE THE FLUX OF PRECIPITATING ELECTRONS USING ELECTROSTATIC FOCUSING TO DEFINE THE ENERGY INTERVAL AND AN ELECTRON MULTIPLIER (BENDIX CHANNELTRON) AS A PARTICLE DETECTOR. THE MAGNETIC PHENOMENA ARE MEASURED WITH THE X-AXIS MAGNETOMETER. THE OUTPUT IS FILTERED AND AMPLIFIED BY A FACTOR OF 100. THE HALF-POWER POINTS ON THE FILTER ARE AT 0.03 HZ AND 3 HZ. AFTER AMPLIFICATION THE FULL SCALE TELEMETRY READING IS <math>\pm 500</math> GAMMA WITH A SENSITIVITY OF 5 GAMMA. THE PARTICLE AND MAGNETOMETER DATA ARE SUBCOMMUTATED WITHIN THE SSED PACKAGE SO THAT ONLY ONE CHANNEL OF SATELLITE ANALOG TELEMETRY IS USED. THE 2 OUTPUTS ARE SAMPLED ALTERNATELY AS PROGRAMMED. PARTICLE DATA ARE OBTAINED ONLY ON PASSES WITHIN VIEW OF THE APL COMMAND STATION. SINCE THE SPACECRAFT IS STABILIZED TO WITHIN ABOUT 20 DEG OF ZENITH AND THE INSTRUMENT COLLIMATOR ADMITS ONLY PARTICLES WITHIN ABOUT 13 DEG OF THE AXIS, PARTICLES WITH LOCAL PITCH ANGLES BETWEEN 0 AND 33 DEG WILL BE SAMPLED.</p>									
32. PHENOMENA OBSERVED									
PRECIPITATING ELECTRONS WITH LOCAL PITCH ANGLES FROM 0 TO 33 DEG									
33. MEASUREMENT RANGE									
FLUX FROM 10 THOUSAND TO 10 BILLION ELECTRONS/SEC/SQ CM/STER									
34. PRECISION AND ACCURACY									
MAGNETIC PHENOMENA TO PLUS OR MINUS 5 GAMMA									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
4. TO 13. KEV NA		
38. FIELD OF VIEW	39. GROUND SWATH	
33. DEG NA		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
33. DEG NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
		46. ECCENTRIC: HIGH
45. SPECIAL REQUIREMENTS		RETROGRADE
47. COMPONENTS		
ELECTRON MULTIPLIER, X-AXIS MAGNETOMETER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY	60. DELAYED TELEMETRY
		61. FREQUENCY OF OBSERVATION
62. TELEMETRY REQUIREMENTS	AS PROGRAMMED	
63. ADVANTAGES AND LIMITATIONS		
ELECTRON SHEATH NEAR SPACECRAFT INTERFERES WITH EXP.		
64. REFERENCES		
1) NASA PRESS KIT FOR GEOS-B. RELEASE NO: 68-2K, JAN 7, 68. **2) PLAN OF OPERATIONS FOR THE GEOS-B SPACECRAFT. REPORT NO. R-4035-45-2. COMMUNICATIONS AND SYSTEMS INC., OCT. 1967.		
65. HISTORICAL REMARKS		
GEOS 2 IS ALSO KNOWN AS EXPLORER 36.		
66. DIAGRAMS		

ITOS A

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
FLAT-PLATE RADIOMETER	PPR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0006							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
PARENT, DR. R.J.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					INTEGRATION				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARBACZ, M. L.	NASA HDOTRS	OSMA/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	NA							
26. INSTRUMENT TYPE									
RADIOMETER, IR/VISIBLE LOW-RESOLUTION THERMISTOR BOLOMETER	UNC								
28. APPLICATION	19. SPACECRAFT								
NET	ITOS A								
30. PURPOSE									
31. PRINCIPLES OF OPERATION									
<p>AN IDENTICAL FLAT PLATE RADIOMETER (PPR), WILL ALSO BE FLOWN ON ITOS B AND C AND HAS FLOWN ON TIROS M. THE PRINCIPAL PART OF EACH RADIOMETER IS A THIN ALUMINUM DISK, THE TEMPERATURE OF WHICH IS SENSED BY THERMISTORS MOUNTED ON THE BACK SURFACE. THE HOUSING TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. THERE ARE 2 PAIRS OF SENSORS. ONE DISK OF EACH PAIR IS PAINTED BLACK AND ONE IS ANODIZED ALUMINUM. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RADIATED LONG-WAVE RADIATION. THE ANODIZED ALUMINUM (WHITE) DISKS REFLECT IN THE VISIBLE RANGE BUT ARE BLACK TO IR BEYOND 7 MICRONS. THESE ABSORB THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. ONE BLACK/WHITE PAIR WILL OPERATE AS RADIATIVE EQUILIBRIUM DETECTORS, SIMILAR TO ESSA. THE 2ND PAIR IS OF A NEW THERMAL FEEDBACK DESIGN. THE ENERGY REQUIRED TO MAINTAIN A CONSTANT TEMPERATURE WILL BE MEASURED. THE SET OF 4 RADIOMETERS ARE MOUNTED BETWEEN THE 2 SCANNING RADIOMETERS AND POINT TO THE NADIR. THE FIELD OF VIEW IS 180 DEGREES FOR ALL FOUR SENSORS.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH'S ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 30.0 MICRON		
38. FIELD OF VIEW	39. GROUND SWATH	
SEE ITEM 31	LIMB-TO-LIMB (3500 NM) FROM 500 NM ALT	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
42. POINTING ACCURACY	43. POINTING RATE	45. INCLINATION
	MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS		
47. COMPONENTS		
4 SENSORS (THERMISTORS), ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. MAGNETIC INTERFERENCE	56. THERMAL INTERFERENCE
		57. INTERFERENCE
		58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
VIEW OF HOUSING		
62. TELEMETRY REQUIREMENTS		
15 WORDS CONSTITUTE ONE PPR FRAME OF DATA, 8 BITS TO THE WORD. THE FRAME IS READ OUT SERIALY AT 15 BPS DATA READOUT TAKING 8 SEC. DATA SAMPLING CYCLE TAKES 32 SEC.		
63. ADVANTAGES AND LIMITATIONS		
64. REFERENCES		
1) DESIGN STUDY REPORT FOR THE IMPROVED TOS(ITOS) SYSTEM, V.1,2. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, JUNE 7, 1968.*** 2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 1968.		
65. HISTORICAL REMARKS		
THIS PPR IS SIMILAR TO THE LRIR FLOWN ON ESSA 3, 5, 7, AND 9.		
66. DIAGRAMS		

ITOS B

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
PLAT-PLATE RADIONETER	PFR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0006							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
PARENT, DR. R.J.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
CARBACZ, M.L.	NASA HDQTRS	OSSA/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
26. INSTRUMENT TYPE	27. SECURITY								
RADIONETER, IR/VISIBLE LOW-RESOLUTION THERMISTOR BOLOMETER	UNC								
28. APPLICATION	29. SPACECRAFT								
MET	ITOS B								
30. PURPOSE									
<p>31. PRINCIPLES OF OPERATION</p> <p>AN IDENTICAL FLAT PLATE RADIONETER (PFR), WILL ALSO BE FLOWN ON ITOS A AND C AND HAS FLOWN ON TIROS M. THE PRINCIPAL PART OF EACH RADIONETER IS A THIN ALUMINUM DISK, THE TEMPERATURE OF WHICH IS SENSED BY THERMISTORS MOUNTED ON THE BACK SURFACE. THE HOUSING TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. THERE ARE 2 PAIRS OF SENSORS. ONE DISK OF EACH PAIR IS PAINTED BLACK AND ONE IS ANODIZED ALUMINUM. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RADIATED LONG-WAVE RADIATION. THE ANODIZED ALUMINUM (WHITE) DISKS REFLECT IN THE VISIBLE RANGE BUT ARE BLACK TO IR BEYOND 7 MICRONS. THESE ABSORB THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. ONE BLACK/WHITE PAIR WILL OPERATE AS RADIATIVE EQUILIBRIUM DETECTORS, SIMILAR TO ESSA. THE 2ND PAIR IS OF A NEW THERMAL FEEDBACK DESIGN. THE ENERGY REQUIRED TO MAINTAIN A CONSTANT TEMPERATURE WILL BE MEASURED. THE SET OF 4 RADIONETERS ARE MOUNTED BETWEEN THE 2 SCANNING RADIONETERS AND POINT TO THE NADIR. THE FIELD OF VIEW IS 180 DEGREES FOR ALL FOUR SENSORS.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH'S ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 30.0 MICRON		
38. FIELD OF VIEW	39. GROUND SWATH	
SPE ITEM 31	LINE-TO-LINE (3500 NM) FROM 500 NM ALT	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		MED CIRCULAR
45. SPECIAL REQUIREMENTS	46. INCLINATION	SUN-SYNCH RETROGRADE
47. COMPONENTS		
4. SENSORS (THERMISTORS), ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
53. MTBF		
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. INTERFERENCE
		58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
62. TELEMETRY REQUIREMENTS	63. DELAYED TELEMETRY	CONTINUOUS
15 WORDS CONSTITUTE ONE PFR FRAME OF DATA, 8 BITS TO THE WORD. THE FRAME IS READ OUT SERIALY AT 15 BPS DATA READOUT TAKING 8 SEC. DATA SAMPLING CYCLE TAKES 32 SEC.		
64. ADVANTAGES AND LIMITATIONS		
65. REFERENCES		
1) DESIGN STUDY REPORT FOR THE IMPROVED TOS(ITOS) SYSTEM, V.1,2. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS55-9034, JUNE 7, 1968.***		
2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 1968.		
66. HISTORICAL REMARKS		
THIS PFR IS SIMILAR TO THE LRIR FLOWN ON ESSA 3, 5, 7, AND 9.		
66. DIAGRAMS		

ITOS C



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
PLAT-PLATE RADIOMETER		PPR							
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0006					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
PARENT, DR. R.J.		UNIVERSITY OF WISCONSIN		608-262-5938					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. FLT MODEL	
GARBACZ, H. L.		NASA HDOTRS		OSSA/SRO		202-963-4291			
23. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
UNIVERSITY OF WISCONSIN		MADISON, WISCONSIN							
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
RADIOMETER, IR/VISIBLE LOW-RESOLUTION THERMISTOR BOLOMETER		UNC							
MET									
31. PRINCIPLES OF OPERATION									
<p>PRIMARY-TO GATHER DATA TO AID IN DETERMINING: (1) THE GEOGRAPHIC DISTRIBUTION OF ENERGY RADIATED FROM THE EARTH AND THE RELATIONSHIP OF THIS ENERGY TO INCOMING ENERGY FROM THE SUN AND (2) THE REFLECTION AND SCATTERING OF SOLAR RADIATION BY THE EARTH-ATMOSPHERE SYSTEM.</p> <p>AN IDENTICAL PLAT RADIOMETER (PPR), WILL ALSO BE FLOWN ON ITOSA AND B AND HAS FLOWN ON TIROS M. THE PRINCIPAL PART OF EACH RADIOMETER IS A THIN ALUMINUM DISK. THE TEMPERATURE OF WHICH IS SENSED BY THERMISTORS MOUNTED ON THE BACK SURFACE. THERE HOUSING TEMPERATURES ARE SEPARATELY SENSED AND RECORDED. THERE ARE 2 PAIRS OF SENSORS. ONE DISK OF EACH PAIR IS PAINTED BLACK AND ONE IS ANODIZED ALUMINUM. THE BLACK PAINTED SURFACE WILL RESPOND TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND RADIATED LONG-WAVE RADIATION. THE ANODIZED ALUMINUM (WHITE) DISKS REFLECT IN THE VISIBLE RANGE BUT ARE BLACK TO IR BEYOND 7 MICRONS. THESE ABSORB THE RADIATED ENERGY FROM THE EARTH AND EXCLUDE TO A HIGH DEGREE THE DIRECT AND REFLECTED SOLAR RADIATION. ONE BLACK/WHITE PAIR WILL OPERATE AS RADIATIVE EQUILIBRIUM DETECTORS, SIMILAR TO ESSA. THE 2ND PAIR IS OF A NEW THERMAL FEEDBACK DESIGN. THE ENERGY REQUIRED TO MAINTAIN A CONSTANT TEMPERATURE WILL BE MEASURED. THE SET OF 4 RADIOMETERS ARE MOUNTED BETWEEN THE 2 SCANNING RADIOMETERS AND POINT TO THE NADIR. THE FIELD OF VIEW IS 180 DEGREES FOR ALL FOUR SENSORS.</p>									
32. PHENOMENA OBSERVED									
ENERGY RADIATED FROM AND REFLECTED BY THE EARTH'S ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.3 TO 30.0 MICRON					
38. FIELD OF VIEW		38. GROUND SWATH			
SEE ITEM 31		LIMB-TO-LIMB (3500 NM) FROM 500 NM ALT			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				MED CIRCULAR	
				45. INCLINATION	
				SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
4. SENSORS (THERMISTORS), ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
				57. INTERFERENCE	
				58. SHIELDING	
				59. DATA RECOVERY	
				60. DATA RECOVERY	
				61. FREQUENCY OF OBSERVATION	
VIEW OF HOUSING					
62. TELEMETRY REQUIREMENTS					
DELATED TELEMETRY					
CONTINUOUS					
15. WORDS CONSTITUTE ONE PPR FRAME OF DATA, 8 BITS TO THE WORD. THE FRAME IS READ OUT SERIALY AT 15 BPS DATA READOUT TAKING 8 SEC. DATA SAMPLING CYCLE TAKES 32 SEC.					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) DESIGN STUDY REPORT FOR THE IMPROVED TOS(ITOS) SYSTEM, V.1,2. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, JUNE 7, 1968.***					
2) RUBIN, L.: OPERATIONAL PROCESSING OF LOW RESOLUTION IR (LRIR) DATA FROM ESSA SATELLITES. ESSA TECH REPORT NESC-42, FEB. 1968.					
65. HISTORICAL REMARKS					
THIS PPR IS SIMILAR TO THE LRIR FLOWN ON ESSA 3, 5, 7, AND 9.					
66. DIAGRAMS					

NIMBUS 1

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. NAME		5. VERSION	
ADVANCED VIDICON CAMERA SYSTEM (TITLE CONT.)		AVCS		11/10/69		0005			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. NAME		10. DATE	
BEERYS, J.		GODDARD SPACE FLT CENTER		617-494-2532					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
PRESS, H.		GODDARD SPACE FLT CENTER		301-987-6142					
12. TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. STATUS	
MONITOR								POST FLIGHT	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. DATE	
SCHADT, B. B.		NASA HDOTRS		OSSA/SRN		202-962-0891			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		08/64		NA			
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT		30. UNCL	
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON						NIMBUS 1			
31. PURPOSE		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. DYNAMIC RANGE	
NET. ERSF		CLOUD COVER OVER THE EARTH'S SURFACE		14 TO 11400 FOOT-LAMBERTS		8-10 LEVELS OF GRAY, 833 LINE RESOLUTION			
36. PRINCIPLES OF OPERATION		37. MEASUREMENT RANGE		38. DYNAMIC RANGE		39. PRECISION AND ACCURACY		40. INSTRUMENT RESUME	
THE AVCS TEST FLOW ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3 AND 5 ARE SIMILAR EXCEPT FOR THE LENS USED AND NIMBUS HAVING 3 CAMERAS TO ESSA'S 2. ON NIMBUS THE 3 VIDICON CAMERAS ARE DEPLOYED IN A FAN-LIKE ARRAY TO PRODUCE A 3-SEGMENT COMPOSITE PICTURE. EACH CAMERA COVERS A 37-DEG FOV WITH THE CENTER CAMERA POINTING STRAIGHT DOWN. THE OPTICAL AXIS OF THE OTHER 2 UNITS ARE ROTATED 35 DEG TO EITHER SIDE OF LOCAL VERTICAL. A 3-PICTURE SET IS TAKEN EVERY 91 SECS AND COVERS AN AREA OF APPROX 400,000 SQ MI WITH 96 PICTURES PER ORBIT ACQUIRED. THE PICKUP TUBES ARE 833 HI WITH 1-IN DIAM VIDICONS GIVING A LINEAR RESOLUTION OF ABOUT 0.5 NM AT THE OPTICAL CENTER AT 575 NM ALT. EACH OF THE 3 CAMERAS EMPLOY A 17 MM F/4 LENS WITH A SERVOCONTROLLED IRIS FOR EXPOSURE ADJUSTMENT. SHUTTER SPEED IS SET AT 40 MILLISEC EXPOSURE TIME. A POTENTIOMETER ATTACHED TO THE SOLAR ARRAY CONTROLS THE LENS OPENING FROM P/16 WHEN THE SPACECRAFT IS OVER THE EQUATOR TO P/4 WHEN THE S/C IS NEAR THE POLES. THE CAMERAS ARE PROGRAMMED TO OPERATE ONLY AT A SUN ANGLE OF HIGHER THAN 85 DEG. A TAPE RECORDER WITH 1200 FT OF TAPE WILL RECORD 2 COMPLETE ORBITS OF 192 PICTURES. THESE VIDEO SIGNALS ARE TRANSMITTED TO THE GROUND IN 4 MIN USING THE 1707.5 MHZ TRANSMITTER.		41. INSTRUMENT RESUME		42. MEASUREMENT RANGE		43. DYNAMIC RANGE		44. PRECISION AND ACCURACY	
45. INSTRUMENT RESUME		46. MEASUREMENT RANGE		47. DYNAMIC RANGE		48. PRECISION AND ACCURACY		49. INSTRUMENT RESUME	
49. INSTRUMENT RESUME		50. MEASUREMENT RANGE		51. DYNAMIC RANGE		52. PRECISION AND ACCURACY		53. INSTRUMENT RESUME	
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INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM		APT		11/10/69 0004					
4. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
STAMPFL, DR. R.A.		GODDARD SPACE FLT CENTER		301-982-6163					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. CONTRACT NO.		17. STATUS	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. POST FLIGHT	
SCHARDT, B. B.		NASA HQ/ERS		OSSA/SRN		202-962-0891			
23. VENDOR		24. LOCATION		25. LEAD TIME					
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		08/69 NA					
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. SPACECRAFT					
IMAGE, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON		NIMBUS 1		UNC					
29. APPLICATION		30. PURPOSE							
APT		PRIMARY-TO PROVIDE REAL-TIME WIDE-ANGLE CLOUD COVER PICTURES FOR USE BY LOCAL USERS.***SECONDARY-CHECKOUT FOR SENSORS TO BE USED IN FUTURE OPERATIONAL TOS FLIGHTS.							
31. PRINCIPLES OF OPERATION									
<p>THE APT SYSTEM, CONSISTING OF A 1-IN VIDICON ARRANGEMENT, WAS TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 (1 CAMERA), PRIOR TO OPERATIONAL TOS FLIGHTS (ESSA 2,4,6) AND TIROS M (2 CAMERAS). THE VIDICON USED INITIALLY (TIROS 8 AND NIMBUS 1), HAD A DI-ELECTRIC LAYER DEPOSITED ON THE GUN SIDE OF THE PHOTOCONDUCTOR TO STORE THE SCENE INFORMATION. HOWEVER, SINCE THE ELECTRON BEAM ALTERED THE ELECTRIC PROPERTIES OF THIS SURFACE, THE VIDICON WAS UPGRADED FOR FUTURE FLIGHTS. THE CAMERA UTILIZES A TECEA-KINOPTIC, 108-DEG, WIDE ANGLE, F/1.8 OBJECTIVE LENS WITH A 5.7 MM FL. THE SYSTEM AUTOMATICALLY TAKES AND TRANSMITS A PICTURE EVERY 208 SECS WHILE THE SATELLITE IS IN DAYLIGHT. OPTICAL EXPOSURE TIME IS 40 MILLISEC, GIVING SHEAR OF LESS THAN 10 PERCENT OF ONE PICTURE ELEMENT. AN 8-SECOND TURN-ON AND SYNC-SIGNAL PRECEDES THE 200 SECOND TRANSMISSION, AT WHICH TIME THE VIDICON IS SCANNED AT 4 LINES PER SEC, PRODUCING AN 800-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. A 5-WATT TV TRANSMITTER BROADCASTS THE SIGNAL IN THE 136.95 MHZ BAND. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A RECORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE. APT IS COMPATIBLE WITH COMMERCIAL 240 RPM FAX EQUIPMENT.</p>									
32. PHENOMENA OBSERVED									
CLOUD AND TERRAIN FEATURES OF APPROX 1.7 NM OR LARGER									
33. MEASUREMENT RANGE									
DYNAMIC PICTURE RANGE OF 10:1									
34. PRECISION AND ACCURACY									
6 TO 10 LEVELS OF BRIGHTNESS VARIATION									

36. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO 0.65 MICRON		NA			
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG		925 BY 925 NM FROM 600 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.162 DEG APPROXIMATELY		1.7 NM FROM 600 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
1.0 DEG		0.1 DEG/SEC		MED ECCENTRIC SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
VIDICON, ELECTRONICS, TRANSMITTER, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
30 LB				51. STANDBY POWER	
52. INTERFERENCE		53. NUCLEAR		54. PEAK POWER	
55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. SHIELDING		59. SHIELDING		60. WATTS	
61. FREQUENCY OF OBSERVATION		62. FREQUENCY OF OBSERVATION		63. MAGNETIC SHIELDING USED	
SENSITIVE/SENSITIVE		MAGNETIC SHIELDING USED			
64. CALIBRATION		65. DATA RECOVERY		66. FREQUENCY OF OBSERVATION	
67. PUDICIAL MARKS INCLUDED		68. REALTIME TELEMETRY		69. CONTINUOUS DAYTIME	
70. TELEMETRY REQUIREMENTS					
PICTURE IS COMMUNICATED TO AN EARTH STATION IN THE SPACE RES. BAND OF 136-137 MHZ. THE VIDEO OUTPUT REQUIRES 4000 HZ MAXIMUM FREQUENCY CAPABILITY.					
71. ADVANTAGES AND LIMITATIONS					
DIRECT TRANSMISSION ON COMMAND TO MANY RECEIVERS WITHOUT INTERMEDIATE STORAGE. DIELECTRIC SURFACE OF VIDICON LIMITED TUBELIFE.					
72. REFERENCES					
1) SIG ACHIEV IN SAT NET 1958-1964. NASA SP-96.***2) STAMPFL, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS, JOURNAL SMPTE, VOL 73, FEB 1969.***3) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET-OROGRAPHY. PRESENTED AT 13TH ANNUAL TECH SYMP OF SPIE, AUG 1968.***4) HALAKRISHNAN: ADV IN COMM SYSTEMS, VOL 1, CHAPTER 5, STAMPFL.					
73. HISTORICAL REMARKS					
SIMILAR TO APT ON NIMBUS 2: ESSA 2,4,6: TIROS 8: SCHED FOR TIROS M					
74. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
HIGH-RESOLUTION INFRARED RADIOMETER		HRIR							
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
POSHEE, L.L.		GODDARD SPACE PLT CENTER							
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
SCHARDT, B. B.		NASA HQDTRS		OSSA/SRN 202-962-0891				POST FLIGHT	
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
ITT INDUSTRIAL LABS		FORT WAYNE, INDIANA		08/64					
26. INSTRUMENT TYPE		27. SCANNING		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
RADIOMETER, SINGLE-CHANNEL SCANNING INFRARED		MET. ERSP		NIMBUS 1					
<p>PRIMARY-TO MAP THE EARTH'S CLOUD COVER AT NIGHT, THUS COMPLEMENTING THE TV COVERAGE DURING THE DAYTIME PORTION OF THE ORBIT.</p> <p>**SECONDARY- TO MEASURE THE RADIATIVE TEMPERATURE OF CLOUD TOPS AND TERRAIN FEATURES.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE SINGLE-CHANNEL SCANNING HRIR WAS FLOWN ON NIMBUS 1 AND 2. MODIFIED VERSIONS ARE SCHEDULED FOR FLIGHT ON NIMBUS B AND D. THE NIMBUS 1 HRIR CONTAINED A LEAD SELENIDE (PBSE) PHOTOCONDUCTIVE CELL WHICH IS RADIATION COOLED TO -75 DEGREES C AND OPERATES IN THE 3.4 TO 4.2 MICRON REGION. COOLING IS ACCOMPLISHED BY MEANS OF A BLACK COOLING PATCH AT THE BOTTOM OF A HIGHLY REFLECTIVE GOLD-COATED HORN. THE RADIOMETER HAS AN INSTANTANEOUS FOV OF 0.5 DEG, WHICH AT AN ALTITUDE OF 600 NM GIVES A GROUND RESOLUTION OF 5 NM. THE SCAN ERROR IS INCLUDED 45 DEGREES TO THE AXIS OF ROTATION AND CONTINUOUSLY ROTATES THE FIELD OF VIEW OF THE DETECTOR THROUGH 360 DEG IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE VIEW OF THE HOUSING AND SPACE DURING A ROTATION PROVIDE ZERO AND WARM BODY CALIBRATION POINTS. THE RADIATION REFLECTED FROM THE SCAN MIRROR IS CHOPPED AT 1.5 KHZ AT THE FOCUS OF A 4 INCH F/1 MODIFIED CASSEGRAINIAN TELESCOPE. IT IS THEN REFOCUSED AT THE DETECTOR BY RELAY MIRRORS WITH THE 3.4-4.2 MICRON WAVELENGTH FILTER BETWEEN THEM. THE SCAN RATE IS 44.7 RPM. THE OUTPUT SIGNAL HAS AN INFORMATION BANDWIDTH OF 280 HZ. THE INFORMATION IS STORED ON TAPE FOR PLAYBACK ON COMMAND.</p>									
32. PHENOMENA OBSERVED									
EMITTED SURFACE RADIATION FROM 3.4 TO 4.2 MICRONS									
33. MEASUREMENT RANGE									
RADIANCE TEMPERATURE BETWEEN 210 AND 330 DEG K									
34. PRECISION AND ACCURACY									
NOISE EQUIV TEMP DIFF OF 1 K DEG FOR A 250-DEG K BACKGROUND									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
3.4 TO 4.2 MICRONS					
38. FIELD OF VIEW		39. GROUND SWATH			
90. BY 0.5 DEG 1300 NM BY 5 NM FROM 600 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.5 DEG 5 NM FROM 600 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
1.0 DEG		MFD CIRCULAR		45. INCLINATION	
46. SPECIAL REQUIREMENTS		SUN-SYNCH RETROGRADE			
47. COMPONENTS					
RADIOMETER, RECORDER, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
12 LB		4 WATTS		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. SHIELDING	
SENSITIVE		SENSITIVE		12 WATTS	
55. DATA RECOVERY		56. DATA RECOVERY		57. FREQUENCY OF OBSERVATION	
2 MEAS EACH 360 DEG SCAN		DELAYED TELEMETRY		NIGHTSIDE OF ORBIT	
58. TELEMETRY REQUIREMENTS					
THE SIGNAL IS RECTIFIED, RESULTING IN A DC OUTPUT VARYING FROM 0 TO -6 VOLTS AND HAVING A VIDEO BANDWIDTH OF 280 HZ.					
59. ADVANTAGES AND LIMITATIONS					
USEFUL DATA DURING NIGHTTIME; RF INTERFERENCE DEGRADED SOME SCANS. MOVING PARTS.					
60. REFERENCES					
1) NIMBUS HIGH RESOLUTION RADIATION DATA CATALOG AND USERS MANUAL V.1. GSFC, JAN. 65***2) SIG ACHIEV IN SPACE APPLICATIONS 1966. NASA SP-156, 1967.***3) GOLDBERG, I.L.: METEOROLOGICAL IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SOC OF PHOTO-OPTICAL ENGR, AUG 23, 1967.***4) HRIR DATA AVAILABLE FROM: NIMBUS DATA, CODE 650, NASA SPACE SCIENCE DATA CTR, GSFC.					
61. HISTORICAL REMARKS					
ALSO FLOWN ON NIMBUS 2, 3. MODIFIED VERSION WILL FLY ON NIMBUS D					
62. DIAGRAMS					

NIMBUS 2

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	ADVANCED VIDICON CAMERA SYSTEM		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			4. RESUME DATE	AVCS					
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
ARIAUSAS, J.	GODDARD SPACE FLT CENTER		301-982-6621						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
PRESS, H.	GODDARD SPACE FLT CENTER		301-982-6142						
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA-HQ/OTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, N.J.	08/64	NA						
26. INSTRUMENT TYPE									
IMAGER, 1-INCH WIDE-ANGLE HIGH-RESOLUTION VIDICON									
28. APPLICATION	29. SPACECRAFT								
MET. ERSP	NIMBUS 2								
30. PURPOSE									
PRIMARY-TO OBSERVE THE ENTIRE DAYTIME CLOUD COVER OF THE EARTH ONCE A DAY FOR METEOROLOGICAL RESEARCH PURPOSES. ***SECONDARY-TO TEST THE SYSTEM IN SPACE PRIOR TO APPLICATION IN AN OPERATIONAL SPACECRAFT SYSTEM.									
31. PRINCIPLES OF OPERATION									
<p>THE AVCS TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY ON ESSA 3 AND 5 ARE SIMILAR EXCEPT FOR THE LENS USED AND NIMBUS HAVING 3 CAMERAS TO ESSA'S 2. ON NIMBUS THE 3 VIDICON CAMERAS ARE DEPLOYED IN A FAN-LIKE ARRAY TO PRODUCE A 3-SEGMENT COMPOSITE PICTURE. EACH CAMERA COVERS A 37-DEG FOV WITH THE CENTER CAMERA POINTING STRAIGHT DOWN. THE OPTICAL AXIS OF THE OTHER 2 UNITS ARE ROTATED 35 DEG TO EITHER SIDE OF LOCAL VERTICAL. A 3-PICTURE SET IS TAKEN EVERY 91 SECS AND COVERS AN AREA OF APPROX 400,000 SQ MI WITH 96 PICTURES PER ORBIT ACQUIRED. THE PICKUP TUBES ARE 833 SCANLINE, 1-IN DIAM VIDICONS GIVING A LINEAR RESOLUTION OF ABOUT 0.5 NM AT THE OPTICAL CENTER AT 575 NM ALT. EACH OF THE 3 CAMERAS EMPLOY A 17 MM F/4 LENS WITH A SERVOCONTROLLED IRIS FOR EXPOSURE ADJUSTMENT. SHUTTER SPEED IS SET AT 40 MILLISEC EXPOSURE TIME. A POTENTIOMETER ATTACHED TO THE SOLAR ARRAY CONTROLS THE LENS OPENING FROM F/16 WHEN THE SPACECRAFT IS OVER THE EQUATOR TO F/4 WHEN THE S/C IS NEAR THE POLES. THE CAMERAS ARE PROGRAMMED TO OPERATE ONLY AT A SUN ANGLE OF HIGHER THAN 85 DEG. A TAPE RECORDER WITH 1200 FT OF TAPE WILL RECORD 2 COMPLETE ORBITS OF 192 PICTURES. THESE VIDEO SIGNALS ARE TRANSMITTED TO THE GROUND IN 4 MIN USING THE 1707.5 MHZ TRANSMITTER.</p>									
32. PHENOMENA OBSERVED									
CLOUD COVER OVER THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
DYNAMIC RANGE OF 14 TO 11,400 FOOT-LAMBERTS									
34. PRECISION AND ACCURACY									
8-10 LEVELS OF GRAY, 833 LINE RESOLUTION									

35. SPECTRAL RANGE	0.45 TO 0.65 MICRON NA	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH		
37.0	DEG 400 NM DIAM CIRCLE FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION			
0.5	DEG 0.5 NM AT CENTER FROM 575 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
3 VIDICON CAMERAS, ASSOCIATED ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
63 LB		7 WATTS	
52. MTBF	53. MTBF	54. INTERFERENCE	55. INTERFERENCE
		56. INTERFERENCE	57. INTERFERENCE
58. SHIELDING	59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
MAGNETIC SHIELDING USED	SENSITIVE	DELATED TELEMETRY	CONTINUOUS DAYTIME
62. TELEMETRY REQUIREMENTS			
NIMBUS S-BAND TRANSMITTER USED TO TRANSMIT VIDEO SIGNAL TO GROUND STATION USING THE 1707.5 MHZ FREQUENCY.			
63. ADVANTAGES AND LIMITATIONS			
IMPROVEMENTS OVER NIMBUS 1 AVCS IN RELIABILITY, PERFORMANCE, AND LIFE CHARACTERISTICS			
64. REFERENCES			
1) SIGNIFICANT ACHIEVEMENTS IN SATELLITE MET, 1958-1964, NASA SP-96.***2) INSTRUMENTS AND SPACECRAFT OCT 57-MAR 65, NASA SP-3028.***3) NIMBUS 2 USER'S GUIDE. GSFC, JULY 66.***4) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR MET., GSFC, 1968.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, N.C.			
65. HISTORICAL REMARKS			
SIMILAR TO AVCS ON NIMBUS 1, ESSA 3, AND ESSA 5.			
66. DIAGRAMS			

7979



<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
HIGH-RESOLUTION INFRARED RADIOMETER	HRIR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	09/16/69	0003							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
POSNER, L.L.	GODDARD SPACE FLT CENTER								
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
HALEY, DR. R.	NASA	OSSA/SAN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
ITT INDUSTRIAL LABS	FORT WAYNE, INDIANA	05/66							
26. INSTRUMENT TYPE									
RADIOMETER, SINGLE-CHANNEL SCANNING INFRARED									
28. APPLICATION	29. SPACECRAFT								
ERT, ERSP	NIMBUS 2								
30. PURPOSE									
PRIMARY- TO MAP THE EARTH'S CLOUD COVER AT NIGHT TO COMPLEMENT THE TV COVERAGE DURING THE DAYTIME PORTION OF THE ORBIT.*** SECONDARY- TO MEASURE THE TEMPERATURES OF CLOUD TOPS AND TERRAIN FEATURES.									
31. PRINCIPLES OF OPERATION THE SINGLE CHANNEL SCANNING HRIR WAS FLOWN IN NIMBUS 1 AND 2. MODIFIED VERSIONS ARE SCHEDULED FOR FLIGHT ON NIMBUS B AND D. THE NIMBUS 2 HRIR CONTAINED A LEAD SELENIDE (PBSE) PHOTOCONDUCTIVE CELL WHICH IS RADIATION COOLED TO -75 DEGREES C AND OPERATES IN THE 3.4 TO 4.2 MICRON REGION. COOLING IS ACCOMPLISHED BY MEANS OF A BLACK COOLING PATCH AT THE BOTTOM OF A HIGHLY REFLECTIVE GOLD-COATED HORN. THE RADIOMETER HAS AN INSTANTANEOUS FOV OF 1/2 DEG, WHICH AT AN ALTITUDE OF 600 NM GIVES A GROUND RESOLUTION OF 5 NM. THE SCAN MIRROR IS INCLINED 45 DEGREES TO THE AXIS OF ROTATION AND CONTINUOUSLY ROTATES THE FIELD OF VIEW OF THE DETECTOR THROUGH 360 DEG IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE VIEW OF THE HOUSING AND SPACE DURING A ROTATION PROVIDE ZERO AND WARM BODY CALIBRATION POINTS. THE RADIATION REFLECTED FROM THE SCAN MIRROR IS CHOPPED AT 1.5 KHZ AT THE FOCUS OF A 4 INCH F/1 MODIFIED CASSEGRAINIAN TELESCOPE. IT IS THEN REFOCUSSED AT THE DETECTOR BY RELAY MIRRORS WITH THE 3.4-4.2 MICRON WAVELENGTH FILTER BETWEEN THEM. THE SCAN RATE IS 44.7 RPM. THE OUTPUT SIGNAL HAS AN INFORMATION BANDWIDTH OF 280 HZ. THE INFORMATION IS STORED ON TAPE FOR PLAYBACK ON COMMAND OR IS TRANSMITTED DIRECTLY TO APT STATIONS.									
32. PHENOMENA OBSERVED									
33. MEASUREMENT RANGE EMITTED SURFACE RADIATION FROM 3.4 TO 4.2 MICRONS									
34. PRECISION AND ACCURACY RADIANT TEMPERATURE BETWEEN 210 AND 330 DEGREES KELVIN NOISE EQUIVALENT TEMP DIFF OF 1 DEG K FOR A 250 DEG K BACKGROUND									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
3.4 TO 4.2 MICRONS		
38. FIELD OF VIEW	39. GROUND SWATH	
90. BY 0.5 DEG 1300 NM BY 5 NM FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.5 DEG 5 NM FROM 600 ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	MED CIRCULAR	SUN-SYNCH RETROGRADE
47. COMPONENTS		
RADIOMETER, RECORDER, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
12 LB	4 WATTS	51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. INTERFERENCE
		58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
62. TELEMETRY REQUIREMENTS		
2. MEAS EACH 360 DEG SCAN DELAYED AND REALTIME NIGHTSIDE OF ORBIT		
THE AC SIGNAL IS RECTIFIED, RESULTING IN A DC OUTPUT VARYING FROM 0 TO -6 VOLTS AND HAVING A VIDEO BANDWIDTH OF 280 HZ.		
63. ADVANTAGES AND LIMITATIONS		
IMPROVED SHIELDING REDUCED RF INTERFERENCE ON DATA WHEN APT WAS OPERATING; USEFUL DATA ONLY DURING NIGHT.		
64. REFERENCES		
1) NIMBUS 2 USER'S GUIDE. GSFC, JULY 1966.***2) SIG ACHIEV IN SPACE APP 1966. NASA SP-156, 1967.***3) GOLBERG, I.L.: METEORLOGY INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYM OF SOC PHOTO-OPTICAL ENGR., AUG 23, 1968.***4) OBSERVATIONS FROM NIMBUS 1 MET SAT. NASA SP-89, 1965.***5) HRIR DATA AVAILABLE FROM: NIMBUS DATA, CODE 650, NASA SPACE SCIENCE CTR, GSFC.		
65. HISTORICAL REMARKS		
ALSO FLOWN ON NIMBUS 1. 3. MODIFIED VERSION WILL FLY ON NIMBUS D		
66. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM			3. EXP NO					
MEDIUM-RESOLUTION INFRARED RADIOMETER				NRIR					
(TITLE CONT.)				4. RESUME DATE			5. VERSION		
				11/10/69			0004		
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION			8. TELEPHONE					
MCCULLOCH, A.	GODDARD SPACE FLT CENTER			301-982-4347					
9. CO-INVESTIGATOR	10. ORGANIZATION			11. TELEPHONE					
				12. CONTRACT NUMBER			13. FLASH INDEX NUMBER		
				14. FLASH INDEX NUMBER			15. STAFF DATE		
				16. COMPLETION DATE			17. STATUS		
				18. MONITOR			19. AGENCY		
				20. PGM OFFICE			21. TELEPHONE		
				22. VENDOR			23. LOCATION		
				24. DATE			25. LEAD TIME		
				26. INSTRUMENT TYPE			27. SECURITY		
				28. APPLICATION			29. SPACECRAFT		
				30. PURPOSE			31. PRINCIPLES OF OPERATION		
				32. PHENOMENA OBSERVED			33. MEASUREMENT RANGE		
				34. PRECISION AND ACCURACY			35. S/N RATIO OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF +/- 3 DEG C		

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.2	TO 30.0	MICRONS SEE ITEM 31			
38. FIELD OF VIEW		39. GROUND SWATH			
2.8		DEG 29 NM DIAM CIRCLE FROM 600 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
2.8		DEG 29 NM FROM 600 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		47. COMPONENTS		48. WEIGHT	
		RADIOMETER, ELECTRONICS		49. VOLUME	
		14 LB		50. AVERAGE POWER	
		7 WATTS		51. STANDBY POWER	
		52. PEAK POWER		53. MTBF	
		54. INTERFERENCE		55. INTERFERENCE	
		56. INTERFERENCE		57. INTERFERENCE	
		58. SHIELDING		59. DATA RECOVERY	
		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS	
		64. REFERENCES		65. HISTORICAL REMARKS	
		1) NIMBUS 2 USER'S GUIDE. GSFC, JUL 66. ***2) DATA CATALOG OF SATELLITE AND ROCKET EXPERIMENTS. NASA/GSFC, NATIONAL SPACE SCI DATA CTR, REPORT NO. NSSDC 68-01, JAN 68. ***3) SIG ACHIEV IN SPACE APP. NASA SP-156, 1967. ***4) GOLDBERG, I. L.: MET IR INSTRUMENTS FOR SATELLITES. NASA/GSFC, AUG 68. ***5) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER, NASA/GSFC.		SIMILAR IN PURPOSE TO EARLIER TIROS MRR, BUT NEW DESIGN.	
		66. DIAGRAMS			

NIMBUS 3

INSTRUMENT RESUME											
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS											
1. TITLE		2. ACRONYM		3. EXP NO							
HIGH-RESOLUTION INFRARED RADIONETER		HRIR									
(TITLE CONT.)		4. NAME		5. VERSION							
		11/10/69		0004							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE							
CHERRIX, G.T.		GODDARD SPACE FLT CENTER		301-982-5754							
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE							
ALLISON, L.J.		GODDARD SPACE FLT CENTER		301-982-5948							
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. DATE		15. STATUS					
						OPERATIONAL					
16. MONITOR		17. AGENCY		18. PGM OFFICE		19. TELEPHONE					
SCHARDT, B. B.		NASA HDPTRS		OSSA/SEN		202-962-0891					
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME					
ITT INDUSTRIAL LABS		PORT WAYNE, INDIANA		04/69		NA					
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT					
RADIONETER, DUAL-CHANNEL INFRARED SCANNING						NIMBUS 3					
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE					
NET, ERSP		A SINGLE-CHANNEL SCANNING HRIR WAS FLOWN ON NIMBUS 1 AND 2. A MODIFIED VERSION IS SCHEDULED FOR NIMBUS 3. THE NIMBUS 3 HRIR WILL PROVIDE DATA IN 2 SPECTRAL REGIONS. NIGHTTIME DATA (3.4 TO 4.2 MICRONS) WILL PROVIDE CLOUD TOP OR SURFACE TEMPERATURES AS IN PREVIOUS HRIR'S. THROUGH THE USE OF A DUAL BAND-PASS FILTER, DAYTIME DATA (0.7 TO 1.3 MICRONS) WILL PRIMARILY PROVIDE MAPS OF CLOUD COVER BY MEASURING RELATIVE REFLECTED SOLAR RADIATION. THE HRIR SENSES RADIATION WITH A LEAD SELENIDE PHOTO-CONDUCTIVE CELL WHICH IS RADIATIVELY COOLED TO -75 DEG C. THE SCAN MIRROR IS INCLINED 45 DEG TO THE AXIS OF ROTATION AND CONTINUOUSLY ROTATES THE POV OF THE DETECTOR THROUGH 360 DEG AT A RATE OF 48 RPM, IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE VIEW OF THE HOUSING AND SPACE DURING A ROTATION PROVIDE ZERO AND WARM BODY CALIBRATION POINTS. THE RADIATION REFLECTED FROM THE SCAN MIRROR IS CHOPPED AT 1.5 KHZ AT THE FOCUS OF A 4 INCH F/1 MODIFIED CASSEGRAINIAN TELESCOPE. IT IS THEN REFOCUSSED AT THE DETECTOR BY RELAY MIRRORS WITH THE FILTER BETWEEN THEM. THE OUTPUT SIGNAL HAS AN INFORMATION BANDWIDTH OF 350 HZ. THIS INFORMATION IS STORED ON TAPE FOR PLAYBACK ON COMMAND OR CAN BE TRANSMITTED DIRECTLY TO APT GROUND STATIONS.		34. PRECISION AND ACCURACY		35. CLOUD-TOPT ALTITUDE TO 1000 FT; SURFACE TEMP TO APPROX 1 C DEG		36. SPECTRAL RANGE		37. TIME CONSTANT	
		EMITTED CLOUD-TOP AND SURFACE RADIATION DURING NIGHT AND DAY									
		RADIANT TEMPERATURE BETWEEN 210 AND 330 DEG K.									

36. SPECTRAL RANGE		0.7 TO 4.2 MICRONS		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
38. FIELD OF VIEW		90. BY 0.5 DEG 1300 NM BY 5 NM FROM 600 NM ALTITUDE		39. GROUND SWATH			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION		42. POINTING ACCURACY		43. POINTING RATE	
0.5 DEG 5 NM AT CENTER FROM 600 NM ALTITUDE				44. ALTITUDE		45. INCLINATION	
1.0 DEG		MED CIRCULAR		SUN-SYNCH		RETROGRADE	
46. SPECIAL REQUIREMENTS				47. COMPONENTS			
RADIONETER, ELECTRONICS				48. WEIGHT		49. VOLUME	
18 LB		9 WATTS		50. AVERAGE POWER		51. STANDBY POWER	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
2 MEAS EACH 360 DEG SCAN DELAYED AND REALTIME		SENSITIVE RADIATIVE COOLING		62. TELEMETRY REQUIREMENTS		63. VIDEO INFORMATION BANDWIDTH IS 350 HZ.	
64. REFERENCES		65. HISTORICAL REMARKS		66. DIAGRAMS			
1) GOLDBERG, I.L.: METEOROLOGY INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SOC PHOTO-OPTICAL ENGRS, AUG 23, 1968. ***2) NIMBUS B PRESS KIT, NO. 68-84X, NASA MAY 10, 1968 ***3) NIMBUS 2 USER'S GUIDE. GSPC, JULY 1966. ***4) SABATINI, R.R.: NIMBUS B DATA UTILIZATION PLAN. ALLIED RES ASSOC, TECH REPT NO. 4, MARCH, 1968.		SINGLE-CHANNEL HRIR HAS FLOWN ON NIMBUS 1 AND 2.					
68. ADVANTAGES AND LIMITATIONS		69. REFERENCES		70. ADVANTAGES AND LIMITATIONS		71. REFERENCES	
THIS HRIR CAN PROVIDE USEFUL DAYTIME PICTURES WHERE PREVIOUS ONES COULD NOT: MOVING PARTS							
1) GOLDBERG, I.L.: METEOROLOGY INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SOC PHOTO-OPTICAL ENGRS, AUG 23, 1968. ***2) NIMBUS B PRESS KIT, NO. 68-84X, NASA MAY 10, 1968 ***3) NIMBUS 2 USER'S GUIDE. GSPC, JULY 1966. ***4) SABATINI, R.R.: NIMBUS B DATA UTILIZATION PLAN. ALLIED RES ASSOC, TECH REPT NO. 4, MARCH, 1968.							
65. HISTORICAL REMARKS		66. DIAGRAMS		67. VIDEO INFORMATION BANDWIDTH IS 350 HZ.			
SINGLE-CHANNEL HRIR HAS FLOWN ON NIMBUS 1 AND 2.							

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO.		4. PHONE		5. VERSION	
IMAGE-DISSECTOR CAMERA SYSTEM (TITLE CONT.)		IDCS		11/10/69		0004			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CONTRACT NUMBER		10. FLASH INDEX NUMBER	
BRANCHFLOBER, G.		GODDARD SPACE FLT CENTER		301-982-5539		NAS5-9619		14. FLASH INDEX NUMBER	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		12. TYPE		13. CONTRACT NUMBER	
						NAS5-9619		14. FLASH INDEX NUMBER	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
SCHARDT, B. B.		NASA HDOTRS		OSSA/SRN		202-962-0891		OPERATIONAL	
23. VENDOR		24. LOCATION		25. DATE		26. LEAD TIME		27. SECURITY	
ITT INDUSTRIAL LABS		FORT WAYNE, INDIANA		04/69		NA			
28. INSTRUMENT TYPE		29. APPLICATION		30. SPACECRAFT		31. PURPOSE		32. HET	
IMAGE, 1-INCH PHOTOCATHODE ELECTRICALLY-SCANNING VISIBLE				NIMBUS 3					
PRIMARY-TO ACQUIRE HIGH-RESOLUTION PHOTOGRAPHS OF THE EARTH'S DAYTIME CLOUD COVER.									
31. PRINCIPLES OF OPERATION									
<p>THE IMAGE DISSECTOR CAMERA PERFORMS THE FUNCTIONS THAT PREVIOUSLY REQUIRED BOTH AN AVCS AND AN APT. IT HAS ALSO FLOWN ON ATS 3, BUT WITH DIFFERENT OPTICS, AND IS SCHEDULED FOR NIMBUS D. A SCENE IS OPTICALLY FOCUSED ON THE PHOTOCATHODE AND PHOTOELECTRONS ARE EMITTED FROM THE SURFACE IN PROPORTION TO THE INCIDENT ILLUMINATION. THE PHOTOELECTRONS ARE ACCELERATED TOWARD AND FOCUSED ON A PLANE WHICH CONTAINS A PINHOLE APERTURE AT ITS CENTER. THE ELECTRON IMAGE IS DEFLECTED PAST THE APERTURE BY MEANS OF MAGNETIC DEFLECTION. THE APERTURE SAMPLES THE ELECTRON IMAGE AND A SECONDARY-EMISSION ELECTRON-MULTIPLIER SECTION AMPLIFIES THE SIGNAL BY ABOUT 10 MILLION. THE CAMERA IS USED IN THE LINE SCAN MODE WITH THE SPACECRAFT MOTION ALONG THE ORBITAL TRACK PROVIDING THE OTHER SCAN COMPONENT. NO SHUTTER IS REQUIRED AS THE SENSOR IS NON-STORAGE TYPE, AND EXPOSURE TO THE SCENE IS CONTINUOUS. THE VERY NARROW BANDWIDTH (1800 HZ) RESULTS IN GENERATION OF A VIDEO SIGNAL WITH THE HIGH NOMINAL S/N OF 40 DB. THE CAMERA-LINE FREQUENCY IS 4 HZ WITH THE FRAME PERIOD BEING 200 SEC. THE LENS APERTURE IS FIXED AT F/3. THE GROUND RESOLUTION IS 1.7 NM AT THE SUBSATELLITE POINT. REALTIME PICTURES CAN BE TRANSMITTED TO APT RECEIVING STATIONS.</p>									
32. PHENOMENA OBSERVED									
VISIBLE LIGHT REFLECTED FROM EARTH AND ITS CLOUD COVER									
33. MEASUREMENT RANGE									
100 TO 10,000 FOOT-LAMBERTS									
34. PRECISION AND ACCURACY									
800 TV LINE RESOLUTION; S/N = 40 DB AT 10,000 FOOT-LAMBERTS									

35. SPECTRAL RANGE	0.4 TO 0.7 MICRON	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	92.0 BY 92.0 DEG 1300 NM BY 1300 NM FROM 600 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
	MED CIRCULAR	SUN-SYNCH	RETROGRADE
46. SPECIAL REQUIREMENTS			
SPACECRAFT ATTITUDE ERRORS MUST BE HELD TO VERY SMALL VALUES			
47. COMPONENTS			
IMAGE DISSECTOR, SCANNING APERTURE, 12 STAGE ELECTRON MULTIPLIER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
14 LBI	0.2 CU FT	12 WATTS	1 WATT
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. SHIELDING
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
	DELATED AND REALTIME	14 PICTURES/ORBIT	
59. TELEMETRY REQUIREMENTS			
VIDEO BANDWIDTH IS 1800 HZ.			
60. ADVANTAGES AND LIMITATIONS			
REPLACES AVCS AND APT CAMERAS FLOWN ON NIMBUS 1 AND 2; REDUCES NUMBER OF PICTURES TO ONE-SIXTH PREVIOUS AMOUNT.			
61. REFERENCES			
1) NORMYLE, W.J.: NIMBUS B TO TEST NEW WEATHER SENSORS, IN AVIATION WEEK AND SPACE TECHNOLOGY, MAY 6, 1968, PP. 71-69.***2) PRESS KIT NIMBUS B, NASA RELEASE NO. 68-48K, MAY 1968.***3) OSTROM, H. AND O. WEINSTEIN.: A REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY, PRESENTED AT SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, WASH. D.C., AUG 1968.			
62. HISTORICAL REMARKS			
REPLACES AVCS PLUS APT. FLOWN ON ATS 3. SCHEDULED FOR NIMBUS D.			
63. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. IRIS		5. VERSION	
INFRARED INTERFEROMETER/SPECTROMETER (TITLE CONT.)						11/10/69		0006	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
HANEL, R. A.		GODDARD SPACE FLT CENTER		301-982-4528					
CHANEY, L.		UNIVERSITY OF MICHIGAN		313-764-7210					
12. TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. OPERATIONAL	
SCHARPT, B. R.		NASA HDOTRS		GSSA/SRN		202-962-0831			
23. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
TEXAS INSTRUMENTS		DALLAS, TEXAS		04/69		NA			
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
SPECTROMETER, INFRARED INTERFEROMETER								NINBUS 3	
<p>PRIMARY- TO DETERMINE THE VERTICAL PROFILE OF TEMPERATURE, THE VERTICAL DISTRIBUTIONS OF OZONE AND WATER VAPOR, AND THE TEMPERATURE OF THE EARTH'S SURFACE OR CLOUD TOPS. ***SECONDARY-TO IDENTIFY SOME OF THE GASES PRESENT IN THE ATMOSPHERE.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS IS A TWYMAN-GREEN MODIFICATION OF A NICHOLSON INTERFEROMETER SPECTROMETER OPERATING IN THE 5.0 TO 20 MICRON WAVELENGTH REGION WITH A FOV OF 8 DEGREES. RADIATION FROM A CYLINDER OF ATMOSPHERE, WHOSE BASE ON THE EARTH'S SURFACE IS A CIRCLE 80 NM IN DIAMETER, IS REFLECTED INTO THE INSTRUMENT FROM A PLANE MIRROR WHICH ROTATES TO PROVIDE IMC. THE RADIATION IS SPLIT INTO TWO BEAMS, ONE OF WHICH IS REFLECTED FROM A MOVING MIRROR, RECOMBINED AND FOCUSED ONTO A BOLOMETER DETECTOR. INTERFERENCE EFFECTS RESULT FROM THE PATH LENGTH DIFFERENCES IN THE 2 BEAMS AS THE MIRROR MOVES. IT TRAVELS ABOUT 2 NM IN 11 SEC TO GIVE AN INTERFEROGRAM WHICH IS RECORDED ON TAPE. OBSERVATIONS ARE BEGUN 16 SEC APART IN WHICH TIME THE S/C TRAVELS ABOUT 65 NM. THUS THERE IS NO OVERLAP IN SUCCESSIVE OBSERVATIONS. AFTER RECORDING 14 INTERFEROGRAMS, 2 CALIBRATION OBSERVATIONS ARE MADE, ONE FOR A REFERENCE BLACKBODY AT 300 K AND ONE FOR OUTER SPACE. A FOURIER TRANSFORMATION, PERFORMED BY DIGITAL COMPUTER, MUST BE MADE ON EACH TELEMETERED INTERFEROGRAM TO PRODUCE A SPECTRUM. THEN, TO RELATE THIS TO ATMOSPHERIC CONDITIONS, APPROPRIATE SPECTRAL ABSORPTION REGIONS MUST BE CHOSEN AND EMPLOYED IN AN INVERSION OF THE RADIATIVE TRANSFER EQUATIONS</p>									
32. PHENOMENA OBSERVED									
EMISSION FROM THE EARTH IN THE SPECTRAL REGION 5-20 MICRONS									
33. MEASUREMENT RANGE									
NEAR ZERO TO 300 DEGREES KELVIN									
34. PRECISION AND ACCURACY									
FOR TEMP. 2 DEG C; FOR WATER VAPOR AND SCALE HEIGHT. 10 PER CENT									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
5.0 TO 20.0 MICRONS		0.1 MICRON		1.0 MILLISEC	
38. FIELD OF VIEW		39. GROUND SWATH			
8.0		DEG 80 NM DIAM CIRCLE FROM 600 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
8.0		DEG 80 NM FROM 600 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		47. COMPONENTS		48. SPECIAL REQUIREMENTS	
				MED CIRCULAR SUN-SYNCH RETROGRADE	
49. MOTION COMPENSATION REQUIRED TO ELIMINATE SMEAR		50. AVERAGE POWER		51. STANDBY POWER	
		12 WATTS		24 WATTS	
52. THERMAL SHIELDING REQ'D		53. MTBF			
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
57. CALIBRATION		58. DATA RECOVERY		59. FREQUENCY OF OBSERVATION	
				EVERY 15 SECONDS	
60. TELEMETRY REQUIREMENTS		61. DATA RECOVERY			
SEE ITEM 31		DELAYED TELEMETRY			
62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS			
3.75 KBITS FOR 11 OUT OF 16 SECONDS; 18 MEGABITS PER ORBIT					
64. REFERENCES		65. HISTORICAL REMARKS			
1) MINZNER, R.A. ED: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, NASA/ERC PH-67/13, JUNE 1967.***2) HANEL, R.A. AND L. CHANEY: THE INFRARED INTERFEROMETER SPECTROMETER EXPERIMENT (IRTS): VOL.2-METEOROLOGICAL MISSION, NASA/GSPC DOCUMENT X-650-65-75.***3) HANEL, R. AND CHANEY, L.: THE MERITS AND SHORTCOMINGS OF AN IRIS TO OBTAIN MET DATA. GSFC RPT X-620-66-476, OCT 1966.					
66. DIAGRAMS					

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
INTERROGATION, RECORDING, AND LOCATION SYSTEM		IRLS							
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0005					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
COTE, C.E.		GODDARD SPACE FLT CENTER		301-982-4101					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
SCHARDT, B. B.		NASA HQ/RTS		OSSA/SRN		202-962-0891		OPERATIONAL	
23. VENDOR		24. LOCATION		25. FLIGHT DATE		26. LEAD TIME			
RADIATION, INC		MELBOURNE, FLORIDA		04/69 NA					
29. INSTRUMENT TYPE		30. PURPOSE		31. AIRCRAFT		32. SPACECRAFT		33. URG	
TRANSPONDER, UHF		MET. OCEAN, COMM, NAV, BIOL		NIMBUS 3					
PRIMARY- TO DEMONSTRATE THAT A SATELLITE CAN DETERMINE THE POSITION OF PLATFORMS CONTAINING SENSORS, RECORD THEIR DATA, AND THEN RADIO THE RESULTS TO A GROUND STATION FOR DISSEMINATION.*** SECONDARY- TO PROVIDE METEOROLOGICAL AND OTHER DATA AS SENSED BY REMOTE SENSORS.									
31. PRINCIPLES OF OPERATION THIS INSTRUMENT IS SIMILAR TO THAT PLOWN ON NIMBUS D. IT CONSISTS OF A TRANSMITTER (401.5 MHZ) WITH A VACUUM TUBE FINAL STAGE, RECEIVER (466 MHZ), DECODING AND CODING CIRCUITS, RANGE DETECTOR, AND MEMORY (20 KBIT). THE DATA MODULES, EACH WITH A UNIQUE ADDRESS, OF WHICH THE BALLOON INTERROGATION PACKAGE (BIP) IS AN EXAMPLE, CONTAIN A RECEIVER (401.5 MHZ), DECODING AND CODING CIRCUITS, DATA SENSORS AND A TRANSMITTER (466 MHZ). AS THE S/C PASSES WITHIN RANGE OF A COMMAND AND DATA ACQUISITION STATION (CDA) UP TO 20 COMMANDS CAN BE SENT AND STORED IN THE IRLS MEMORY. A COMMAND CONSISTS OF A TIME FOR AN INTERROGATION AND THE ADDRESS OF THE BIP (OR OTHER MODULE) TO BE CONTACTED. WHEN THE STORED COMMAND TIME AND THE S/C CLOCK TIME COINCIDE, THE S/C IRLS TRANSMITS THE ASSOCIATED BIP ADDRESS. THE BIP RESPONDS AND TRANSMITS ITS SENSOR READINGS. THESE AND THE ROUND TRIP SIGNAL DELAY TIME BETWEEN THE BIP AND THE S/C ARE STORED IN THE IRLS MEMORY. THIS PROCEDURE IS REPEATED FOR EACH STORED COMMAND UNTIL THE CDA INITIATES TRANSMISSION OF THE MEMORY CONTENTS AND THE STORAGE OF NEW COMMANDS IN THE MEMORY. KNOWING THE S/C POSITIONS AND TWO RANGES TAKEN ABOUT 150 SEC APART, THE POSITION OF A MODULE CAN BE FOUND TO WITHIN 2 KM.									
32. PHENOMENA OBSERVED TRANSMISSIONS OF DATA FROM REPORTING PLATFORMS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY PLATFORM LOCATION TO +/-0.6 NM; DELAY TIME TO 0.625 MICROSECOND									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
466. AND 401.5 MHZ					
38. FIELD OF VIEW		39. GROUND SWATH			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
		MED CIRCULAR		SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
REACTS ONLY TO PREVIOUS GROUND COMMAND FOR SENSOR INTERROGATION					
47. COMPONENTS					
RECEIVER, TRANSMITTER, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
26 LB		0.4 CU FT		18 WATTS	
51. INTERFERENCE		52. INTERFERENCE		53. SHIELDING	
SOURC/SEN		SENSITIVE		107 WATTS	
54. CALIBRATION		55. DATA RECOVERY		56. FREQUENCY OF OBSERVATION	
		DELATED TELEMETRY		ON COMMAND	
57. TELEMETRY REQUIREMENTS					
20 CHANNELS: 5 DIGITAL AND 15 ANALOG, SAMPLED BETWEEN 1 AND 16 SECONDS; 12.5 KBITS PER SECOND.					
58. ADVANTAGES AND LIMITATIONS					
LIMITED AT PRESENT TO 12 PLATFORMS					
59. REFERENCES					
1) NORRILE, W.J.: NIMBUS B TO TEST NEW WEATHER SENSORS. AVIATION WEEK AND SPACE TECHNOLOGY, MAY 6, 1968, PP. 71-79.*** 2) PRESS KIT NIMBUS B, NASA RELEASE NO: 68-48K, MAY 1968.***3) NIMBUS B COMMAND AND TELEMETRY DIRECTORY, VOL.2: EXPERIMENT SUBSYSTEMS, GENERAL ELECTRIC CO., PHILADELPHIA, PA., 1967.					
60. HISTORICAL REMARKS					
SIMILAR TO NIMBUS D IRLS					
61. DIAGRAMS					

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
MEDIUM-RESOLUTION INFRARED RADIOMETER (TITLE CONT.)	MRIR								
4. RESUME DATE	5. VERSION								
11/10/69	0005								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
McCULLOCH, A.W.	GODDARD SPACE FLT CENTER	301-982-4747							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HDOTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
SANTA BARBARA RES CTR	GOLETA, CALIFORNIA	04/69	NA						
26. INSTRUMENT TYPE									
RADIOMETER, 5-CHANNEL MEDIUM-RESOLUTION SCANNING IR/VISIBLE									
28. APPLICATION	29. SPACECRAFT								
MRIR	NIMBUS 3								
30. PURPOSE									
PRIMARY-TO MEASURE SELECTED ELECTROMAGNETIC RADIATION EMITTED OR REFLECTED FROM THE EARTH AND ITS ATMOSPHERE TO OBTAIN DATA ON THE ALBEDO OF THE EARTH-ATMOSPHERE SYSTEM, WATER VAPOR DISTRIBUTION, SURFACE OR CLOUD TEMPERATURES AND SEASONAL CHANGES OF STRATOSPHERIC TEMPERATURES.***SECONDARY- TO PROVIDE ABSOLUTE RADIOMETRIC DATA TO AID IN EVALUATING DATA OF OTHER EXPERIMENTS.									
31. PRINCIPLES OF OPERATION THE 5 CHANNEL NIMBUS MRIR IS SIMILAR IN PURPOSE TO THE EARLIER TIROS MRIR, BUT USES AN ENTIRELY NEW INSTRUMENT DESIGN. RADIATION ENTERS THE RADIOMETER BY REFLECTION FROM A PLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. A MECHANICAL CHOPPER MODULATES THE RADIATION AT 60 HZ. THE SPECTRAL REGIONS ARE SELECTED BY FILTERS. FOR THIS MRIR THE REGIONS (IN MICRONS) ARE 6.4-6.9 FOR WATER VAPOR DISTRIBUTION IN THE TROPOSPHERE, 10-11 FOR SURFACE OR CLOUD TEMPERATURES, 14.5-15.5 FOR STRATOSPHERIC TEMPERATURES, 20-23 FOR ANOTHER WATER VAPOR MEASUREMENT, AND 0.2-4.0 FOR ALBEDO MEASUREMENTS. EACH CHANNEL HAS A SEPARATE OPTICAL SYSTEM CONTAINING A FOLDED TELESCOPE WITH A 1.7 IN. DIAMETER OBJECTIVE AND A 2.8 DEG POV. THE RADIATION IS FOCUSED ONTO A THERMISTOR BOLLOMETER DETECTOR. THE SCANNING MIRROR ROTATES AT 8 RPM SCANNING IN A PLANE NORMAL TO THE S/C VELOCITY. DURING EACH REVOLUTION THE MIRROR VIEWS SPACE, THE EARTH FROM HORIZON TO HORIZON, SPACE AGAIN, AND THE RADIOMETER HOUSING. THE TEMPERATURES RECORDED FOR SPACE AND THE HOUSING ARE USED FOR CALIBRATION. THE OUTPUT FOR EACH DETECTOR IS A ZERO TO 6.4 VOLT ANALOG SIGNAL. THIS IS CONVERTED TO AN 8-BIT DIGITAL SIGNAL AND STORED ON TAPE FOR TRANSMISSION OVER S-BAND UPON COMMAND.									
32. PHENOMENA OBSERVED INFRARED RADIATION FROM THE EARTH AND ATMOSPHERE									
33. MEASUREMENT RANGE 185-300 DEG K FOR 10 MCRN CHAN; 185-270 DEG K FOR 6, 15 MCRN CHANS									
34. PRECISION AND ACCURACY S/N OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF +-7 DEG C									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.2 TO 23.0 MICRON		2.0 MILLISEC
38. FIELD OF VIEW	39. GROUND SWATH	
360.0 BY 2.8 DEGLIMB-TO-LIMB (3800 NM) FROM 600 NM ALT		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
2.8 DEGL 25 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
	MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS		
47. COMPONENTS		
RADIOMETER, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
20 LB		8 WATTS
51. STANDBY POWER	52. PEAK POWER	53. MTBF
	2 WATTS	
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. INTERFERENCE
58. SHIELDING	59. CALIBRATION	60. DATA RECOVERY
		SENSITIVE
61. FREQUENCY OF OBSERVATION	62. TELEMETRY REQUIREMENTS	63. ADVANTAGES AND LIMITATIONS
	SPACE AND MRIR HOUSING	DELATED TELEMETRY
		CONTINUOUS
ANALOG SIGNALS ARE SAMPLED 33-1/3 TIMES PER SEC AND CONVERTED TO 8-BIT DIGITAL DATA. EACH DATA WORD BIT IS THEN RECORDED ON TAPE FOR PLAYBACK.		
IMPROVED SPECTRAL RESPONSE AND IN-FLIGHT CALIBRATION HAS INCREASED ACCURACY OF DATA OVER TIROS MRIR; MOVING PARTS.		
64. REFERENCES		
1) GOLDBERG, I.L.: METEOROLOGICAL INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SOC PHOTO-OPTICAL ENGRS, AUG 23, 1968. ***2) NIMBUS B PRESS KIT, NO-68-84K, NASA, MAY 10, 1968. ***3) NIMBUS 2 USER'S GUIDE. GSFC, JULY 1966. ***4) SABATINI, R.R. NIMBUS B DATA UTILIZATION PLAN. ALLIED RES. ASSOC, TECH REPT NO. 4, MARCH 1968.		
65. HISTORICAL REMARKS		
SIMILAR IN PURPOSE TO EARLIER TIROS MRIR		
66. DIAGRAMS		



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
<b>MONITOR OF ULTRAVIOLET SOLAR ENERGY</b>									
1. TITLE (TITLE CONT.)	2. ACRONYM	3. EXP NO							
	MUSE								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
HEATH, DR. D.P.	GODDARD SPACE FLT CENTER	301-982-6421							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					OPERATIONAL				
18. MONITOR	19. AGENCY	20. POW OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA-HQ/OTRS	OSSN/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
ADCOLE CORPORATION	WALTHAM, MASS	04/69 NA							
26. INSTRUMENT TYPE									
SPECTROMETER, 5-CHANNEL OPTICAL-FILTER PHOTODIODE									
28. APPLICATION	29. SPACECRAFT								
HEV. ATH-PHYS	NINBUS 3								
30. PURPOSE									
<p>PRIMARY-TO DETECT VARIATION OF RELATIVE INTENSITY OF SOLAR FLUX IN 5 SPECTRAL BANDS:***SECONDARY-TO MAKE ABSOLUTE MEASUREMENTS OF THE FLUX, TO MEASURE THE RATE OF DECREASE OF FLUX AS THE SATELLITE ENTERS THE EARTH SHADOW NEAR THE POLES, TO MEASURE ATMOSPHERIC OZONE.</p>									
<p>THIS EXPERIMENT, SIMILAR TO ONE FLOWN ON NINBUS D, USES 5 PHOTODIODES TO MONITOR THE FLUX FROM THE SUN IN 5 WAVELENGTH REGIONS. THESE REGIONS ARE AT 1216 A (THE HYDROGEN LYMAN ALPHA LINE), 1600 A WITH 150 A WIDTH, 1800 A WITH 300 A WIDTH, 2100 A WITH 450 A WIDTH, AND 2600 A WITH 600 A WIDTH. OPTICAL FILTERS DETERMINE THE SHORT WAVELENGTH CUTOFF FOR EACH REGION, AND THE CHOICE OF PHOTOCATHODE MATERIAL DETERMINES THE LONG WAVELENGTH CUTOFF. A SOLAR ASPECT SENSOR GIVES THE ANGLE AT WHICH THE SUN'S RAYS STRIKE THE DIODES WITH 7 BIT ACCURACY. USABLE DATA IS OBTAINED OVER A 100 DEG FOV. THE RADIATION INTENSITY IS READ AS THE CURRENT FROM THE PHOTODIODES BY EITHER OF TWO PARALLEL ELECTROMETERS WITH FOUR DECADE RANGES. THERE IS AN AUTOMATIC ZERO SETTING DEVICE FOR THE ELECTROMETERS. THEY ARE CALIBRATED USING 5 CONSTANT CURRENTS SUPPLIED BY A RADIOACTIVE SOURCE (AM 241). AN EXPERIMENT CYCLE TAKES 48 SEC INCLUDING CALIBRATION CHECKS, HOUSEKEEPING CHECKS AND SENSOR DATA. EACH SENSOR IS MONITORED FOR 5 SEC PER CYCLE. WHEN THE S/C IS OVER THE POLAR REGIONS THE EARTH'S ATMOSPHERE ATTENUATES THE UV SEEN BY THE SENSORS. THIS OPACITY MEASUREMENT CAN GIVE COARSE MEASURES OF THE OZONE AND MOLECULAR OXYGEN IN THE STRATOSPHERE.</p>									
<p>32. PHENOMENA OBSERVED</p>									
ULTRAVIOLET SOLAR RADIATION FLUX									
33. MEASUREMENT RANGE									
SIGNAL CURRENT FROM 0.1 TO 100 NANOAMPS									
34. PRECISION AND ACCURACY									
ABSOLUTE ACCURACY OF FLUX MEASUREMENTS WITHIN 20 PERCENT									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
1200. TO 2600. A		
38. FIELD OF VIEW	39. GROUND SWATH	
100.	DEG 1400 NM DIAM CIRCLE FROM 600 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.7 DEG 17 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	MED CIRCULAR	SUN-SYNCH RETROGRADE
47. COMPONENTS	PHOTODIODE DETECTORS, SUN ASPECT SENSOR, ELECTRONICS	
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
53. CALIBRATION	54. INTERFERENCE	55. NUCLEAR INTERFERENCE
		56. THERMAL INTERFERENCE
		57. SHIELDING
58. DATA RECOVERY	59. FREQUENCY OF OBSERVATION	
CONSTANT CURRENTS	DELATED TELEMETRY	25 MIN PER ORBIT
60. TELEMETRY REQUIREMENTS		
30 BIT DIGITAL WORD READ ONCE EVERY SECOND AT 4 KBITS PER SEC.		
61. ADVANTAGES AND LIMITATIONS		
62. REFERENCES		
<p>1) NORMYLE, W.J.: NINBUS B TO TEST NEW WEATHER SENSORS, IN AVIATION WEEK AND SPACE TECHNOLOGY, MAY 6, 1968, PP. 74-79.***</p> <p>2) PRESS KIT, NINBUS B, NASA RELEASE NO: 68-48K, MAY 1968.***3)</p> <p>NINBUS B COMMAND AND TELEMETRY DIRECTORY, VOL 2, EXPERIMENT SUB-SYSTEMS. GENERAL ELECTRIC CO. PHILADELPHIA, PA. AUG. 1967.</p>		
63. HISTORICAL REMARKS		
64. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME DATE		5. VERSION	
SATELLITE INFRARED SPECTROMETER (TITLE CONT.)		SIRS				11/10/69 0005			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
MARK, DR. D.O.		NAT ENV SAT CTR, ESSA		301-440-7114		HILGARY, D.T.		NAT ENV SAT CTR, ESSA	
12. CONTRACT NUMBER		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
12. CONTRACT TYPE		13. CONTRACT STATUS		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. INSTRUMENT TYPE	
SCHARDT, B. B.		NASA HQDTR		OSSA/SRN		202-962-0891		23. LOCATION	
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		26. INSTRUMENT TYPE	
ESSA		SUTLAND, MARYLAND		04/69 NA				27. LABEL	
28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED	
SPECTROMETER, 8-CHANNEL IR FASTIE-EBERT FIXED-GRATING		NIMBUS 3		PRIMARY- TO MEASURE THE TEMPERATURE PROFILE FROM THE EARTH'S SURFACE OR CLOUD TOPS TO 15 MILE ALTITUDE. ***SECONDARY- TO MEASURE SURFACE TEMPERATURE OR CLOUD TOP TEMPERATURE AND ITS HEIGHT.		THE INSTRUMENT IS A FASTIE-EBERT GRATING INFRARED SPECTROMETER WITH A WEDGE-IMMERSED THERMISTOR BOLOMETER AS DETECTOR AT EACH OF 8 EXIT SLITS. RADIATION IS MONITORED IN 7 INTERVALS (5-8 INV. CM. HALF POWER BANDWIDTHS) IN THE CO2 BAND FROM 13 TO 15 MICRONS AND IN 1 INTERVAL IN THE ATMOSPHERIC WINDOW AT 11.1 MICRONS. A TWO POSITION PLANE MIRROR REFLECTS EITHER A BLACK BODY CALIBRATION SOURCE OR EARTH RADIATION TO A CHOPPER WHICH ALTERNATELY VIEWS THIS RADIATION OR COLD SPACE. FROM THERE THE RADIATION PASSES THRU AN ORDER LIMITING INTERFERENCE FILTER, STRIKES A 25 IN. FOCAL LENGTH SPHERICAL MIRROR, A 5 IN. -1250 LINES/IN. DIFFRACTION GRATING, THE SPHERICAL MIRROR AGAIN, AND FINALLY THE EXIT SLITS. EARTH RADIATION IS GATHERED CONTINUOUSLY FROM A VIEWING ANGLE OF 0.04 STERADIAN (12x12 DEG) CENTERED ON THE NADIR. THIS GIVES DATA ALONG A NORTH-SOUTH STRIP WHOSE PROJECTION ON THE GROUND IS 120 NM WIDE. ADJACENT STRIPS ARE SEPARATED BY ABOUT 1600 NM AT THE EQUATOR. THE 11.1 MICRON DATA GIVES SURFACE OR CLOUD TOP TEMPERATURES. THE 15 MICRON DATA IS USED A GENERATE VERTICAL, TEMPERATURE-PRESSURE PROFILES BY A MATHEMATICAL INVERSION TECHNIQUE. DATA IS ACCUMULATED IN 6 SEC INTERVALS TO GIVE PROFILES EACH 50 MILES ALONG THE STRIP.		IR RADIATION EMITTED FROM THE EARTH'S ATMOSPHERE, SURFACE, CLOUDS	
33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. TEMPERATURE TO 1 DEG K; PRESSURE TO 10 MB					

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
11.1 TO 15.0 MICRONS		0.6 PERCENT			
39. GROUND SWATH		40. ALTITUDE		41. INCLINATION	
12.0 BY 12.0 DEG 120 NM BY 120 NM FROM 600 NM ALTITUDE		44. ALTITUDE		45. INCLINATION	
42. POINTING ACCURACY		43. POINTING RATE		46. SPECIAL REQUIREMENTS	
12.0 DEG 120 NM FROM 600 NM ALTITUDE				MED CIRCULAR SUN-SYNCH RETROGRADE	
47. COMPONENTS		48. WEIGHT		49. VOLUME	
FIXED-GRATING IR SPECTROMETER, CALIBRATION SOURCE, ELECTRONICS		91 LB		CU FT	
50. AVERAGE POWER		51. STANDBY POWER		52. PEAK POWER	
21 WATTS				33. MTBF	
53. INTERFERENCE		54. INTERFERENCE		55. SHIELDING	
SENSITIVE		SENSITIVE		SENSITIVE	
56. DATA RECOVERY		57. INTERFERENCE		58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
BLK BDY RADIATION SOURCE DELAYED TELEMETRY		CONTINUOUS			
62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS		64. REFERENCES	
9 PRIMARY CHANNELS WITH 10 BIT ACCURACY, ALL SAMPLED WITHIN 100 MILLISECONDS AND TELEMETRED TWICE EVERY 16 SECONDS				1) GOLDBERG, I.L.: METEOROLOGICAL IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SPIE, AUG 1968.***2) NIMBUS B PRESS KIT, NASA RELEASE NO. 68-84K, MAY 1968.***3) MINZNER, R.A. ED: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, NASA ERC PM-6713, JUNE 1967.	
65. HISTORICAL REMARKS		66. DIAGRAM			

NIMBUS D

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
BACKSCATTERED ULTRAVIOLET RADIATION EXPERIMENT	BUV								
(TITLE CONT.)	4. RESUME	5. REGION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
HEATH, DR. D. P.	GODDARD SPACE FLT CENTER	301-982-6421							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
MATEER, C. L.	NATL CTR FOR ATMOS RES								
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. START DATE	15. STATUS					17. STATUC	
								PROTOTYPE	
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HQTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. FIGURE	25. DATE	26. LEAD TIME					
NATL CTR FOR ATMOS RES			03/70						
28. INSTRUMENT TYPE									
SPECTROMETER, EBERT-TYPE GRATING ULTRAVIOLET PHOTOMETRIC									
29. APPLICATION									
30. PURPOSE									
31. PRINCIPLES OF OPERATION									
THE MAIN INSTRUMENT IS A DOUBLE MONOCHROMATOR COMPOSED OF TWO EBERT-TYPE MONOCHROMATORS IN TANDEM. EACH HAS A GRATING 64X64 MM WITH 2400 LINES/MM. LIGHT FROM A 0.05 STERADIAN SOLID ANGLE (SUBTENDING A 120X120 MM AREA ON THE EARTH'S SURFACE FROM 600NM) ENTERS THE RADIR POINTING INSTRUMENT THRU A DEPOLARIZING FILTER. A MOTOR-DRIVEN CAM STEP-ROTATES THE GRATINGS TO MONITOR THE INTENSITY OF 12 OZONE ABSORPTION WAVELENGTHS AT 2555, 2735, 2830, 2876, 2922, 2975, 3019, 3058, 3125, 3175, 3312 AND 3398 A WITH A CENTER WAVELENGTH ACCURACY OF 0.2 A AND A BANDPASS OF 10A SET BY THE SLIT SYSTEM. THE DETECTOR IS A PHOTOMULTIPLIER TUBE. FOR BACKGROUND READINGS, A FILTER PHOTOMETER MEASURES THE REFLECTED UV IN A WAVELENGTH REGION (NEAR 3800 A) FREE OF OZONE ABSORPTION. SIGNALS FROM BOTH UNITS ARE READ BY SEPARATE RANGE-SWITCHING ELECTROMETERS WITH 7 DECADE RANGES. UNDER AVERAGE SUN-LIGHT CONDITIONS THE SIGNAL IS CALCULATED TO BE 3 MILLIAMP AT 3400 A DOWN TO 0.2 MICROAMP AT 2550 A. A MEASUREMENT CYCLE TAKES 40 SEC INCLUDING 10 SEC FOR CALIBRATION BY ON-BOARD LIGHT SOURCES. ONCE EACH ORBIT THE FOV IS SWITCHED TO MONITOR THE SUN OR MOON DIRECTLY. THE VERTICAL DISTRIBUTION OF OZONE IS OBTAINED BY MATHEMATICAL INVERSION TECHNIQUES.									
32. PHENOMENA OBSERVED									
ULTRAVIOLET RADIATION FROM THE EARTH'S ATMOSPHERE									
33. MEASUREMENT RANGE									
SIGNAL CURRENT FROM 0.2 TO 3000 MICROAMPS									
34. PRECISION AND ACCURACY									
WAVELENGTH TO 0.5 A; INTENSITY TO 2 PERCENT									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
2500. TO 3400. A	0.35 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
13. DEG	135 NM DIAM CIRCLE FROM 600 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
13. DEG	135 NM FROM 600 NM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
2. DEG	MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS		
47. COMPONENTS		
SPECTROMETER, PHOTOMETER, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
32 LB	0.78 CU FT	7 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. INTERFERENCE
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
SEE ITEM 31	DELAYED TELEMETRY	
62. TELEMETRY REQUIREMENTS		
INFORMATION STORED: 13 READINGS WITH 7 BIT ACCURACY, EACH 0.5 SEC. HOUSEKEEPING ALSO.		
63. ADVANTAGES AND LIMITATIONS		
MOVING PARTS		
64. REFERENCES		
1) KOPPE-BAKER, N.B.: BUV SUBSYSTEM DIRECTORY (PRELIM VERSION) GENERAL ELECTRIC CORP., PHILADELPHIA, PA.***2) DAVE, J.V. AND HEATH, D.P.: PROPOSAL TO DETERMINE THE SPATIAL DISTRIBUTION OF ATMOSPHERIC OZONE FROM MEASUREMENTS OF ULTRAVIOLET RADIATION BACKSCATTERED BY THE EARTH'S ATMOSPHERE (NOV. 1965).		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
<b>FILTER-WEDGE SPECTROMETER</b>	<b>PWS</b>								
(TITLE CONT.)	4. DATE	5. VERSION							
	11/10/69	0003							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
<b>HOVIS, DR. W. A.</b>	<b>GODDARD SPACE PLT CENTER</b>	<b>301-982-6465</b>							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. START DATE	15. STATUS					17. STATUS	
18. MONITOR	19. AGENCY	20. POM OFFICE	21. TELEPHONE						PROTOTYPE
<b>SCHARDT, B. B.</b>	<b>NASA HQTRS</b>	<b>OSSA/SRN</b>	<b>202-962-0891</b>						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
		<b>03/70</b>							
26. INSTRUMENT TYPE									27. SECURITY
<b>SPECTROMETER, CIRCULAR-WEDGE INTERPERENCE-FILTER INFRARED</b>									<b>UNC</b>
28. APPLICATION									
<b>NET</b>									
29. PURPOSE									
PRIMARY- TO DETERMINE THE LATERAL DISTRIBUTION OF THE TOTAL WATER VAPOR CONTENT PER UNIT VERTICAL COLUMN. **SECONDARY- TO DETERMINE THE VERTICAL DISTRIBUTION OF WATER VAPOR CONTENT IN ANY PARTICULAR UNIT VERTICAL COLUMN. AND THE LATERAL VARIATION OF THE VERTICAL DISTRIBUTION.									
31. PRINCIPLES OF OPERATION	THE INSTRUMENT IS AN IR RADIOMETER WHICH PASSES INCIDENT RADIATION THROUGH A CONTINUOUSLY ROTATING (ONCE EVERY 16 SEC) FILTER WHEEL. THE FILTER WHEEL IS A 2-SEGMENT 100-LAYER INTERPERENCE FILTER WITH THE LAYER THICKNESS LINEARLY INCREASING AS A FUNCTION OF ANGULAR POSITION, CAUSING THE BAND PASS TO SHIFT TOWARD THE LONGER WAVELENGTH. ONE SECTOR TRANSMITS THE 3.2-6.4 MICRON BAND AND THE OTHER THE 1.2-2.4 MICRON BAND. AN INNERSED LEAD SENEIDE DETECTOR IS USED. INCIDENT RADIATION IS SAMPLED 20 TIMES A SECOND. THE RESULT IS A SPECTRAL INTENSITY PLOT OF 158 POINTS FOR EACH PASSBAND PER REVOLUTION. A TELESCOPE ORIENTED NORMAL TO THE EARTH'S SURFACE COLLECTS ATMOSPHERIC RADIATION FROM A 3 DEG FOV DIRECTLY BELOW THE SATELLITE. AT A 600NM ALTI-TUDE IN A SUN-SYNCHRONOUS ORBIT, A POLE-TO-POLE STRIP OF ATMOS-PHER 31 NM WIDE IS VIEWED ON EACH SATELLITE PASS WITH A 1330 NM SEPARATION BETWEEN SUCCESSIVE STRIPS AT THE EQUATOR. NARROW SPECTRAL REGIONS IN THE CO2 AND H2O ABSORPTION BANDS AT 4.3 AND 6.3 MICRON AND IN A WINDOW REGION ARE OF INTEREST. CALIBRATION IS ACCOMPLISHED BY CHOPPING AGAINST A BLACKBODY OF KNOWN TEMPERATURE, 27+-0.5 DEG C. THE SPECTRA ARE ANALYZED BY THE METHOD OF INVERSION OF RADIATIVE TRANSFER EQUATIONS.								
32. PHENOMENA OBSERVED									
<b>INFRARED SPECTRAL RADIANCE OF EARTH'S ATMOSPHERE</b>									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
1.2 TO 6.4 MICRON	2.3 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
3. DEG 30 BY 30 NM FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
3. DEG 30 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	47. COMPONENTS	
	SPECTROMETER, TELESCOPE, 2 DETECTORS, ELECTRONICS	
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
13 LB	0.3 CU FT	51. STANDBY POWER
		52. PEAK POWER
53. INTERFERENCE	54. INTERFERENCE	55. INTERFERENCE
		56. SHIELDING
57. INTERFERENCE	58. INTERFERENCE	59. INTERFERENCE
		60. DATA RECOVERY
61. FREQUENCY OF OBSERVATION	62. TELEMETRY REQUIREMENTS	63. ADVANTAGES AND LIMITATIONS
SENSITIVE RADIATIVE COOLING	298 BITS PER SECOND	LOW COST, LOW POWER DRAIN, SIMPLE INSTRUMENT; RESULTS LIMITED TO LOWER ALTITUDES, HAS MOVING PARTS
64. REFERENCES	65. HISTORICAL REMARKS	66. DIAGRAMS
1) GARAPOLE, P.: FWS SUBSYSTEM DIRECTORY (PRELIM), GENERAL ELECTRIC CO., PHILADELPHIA, PA., DEC. 1967. ***2) MINZNER, R.A., INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS. NASA/ERC REPORT NO. PM-6713, JUNE 1967.		

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
<b>IMAGE-DISSECTOR CAMERA SYSTEM</b> (TITLE CONT.)						4. RESUME DATE 11/10/69			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
BRANCHFLOWER, G.		GODDARD SPACE FLT CENTER		301-982-5539					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. STATUS	
NASS-9619								17. STATUS	
18. MONITOR		19. AGENCY		20. POM OFFICE		21. TELEPHONE		22. FLIT MODEL	
SCHARDT, B. B.		NASA HDOTRS		OSSA/SRN		202-962-0891			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
ITT INDUSTRIAL LABS		FORT WAYNE, INDIANA		03/70					
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
IMAGER, 1-INCH ELECTRICALLY-SCANNING PHOTOCATHODE VISIBLE		UNC							
31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. ADVANTAGES AND LIMITATIONS	
THE IMAGE DISSECTOR CAMERA PERFORMS THE FUNCTIONS THAT PREVIOUSLY REQUIRED BOTH AN AVCS AND AN APT. IT HAS ALSO FLOWN ON ATCS 3, BUT WITH DIFFERENT OPTICS, AND IS CURRENTLY FLYING ON NIMBUS 3. A SCENE IS OPTICALLY FOCUSED ON THE PHOTOCATHODE AND PHOTOELECTRONS ARE EMITTED FROM THE SURFACE IN PROPORTION TO THE INCIDENT ILLUMINATION. THE PHOTOELECTRONS ARE ACCELERATED TOWARD AND FOCUSED ON A PLANE WHICH CONTAINS A PINHOLE APERTURE AT ITS CENTER. THE ELECTRON IMAGE IS DEFLECTED PAST THE APERTURE BY MEANS OF MAGNETIC DEFLECTION. THE APERTURE SAMPLES THE ELECTRON IMAGE AND A SECONDARY-EMISSION ELECTRON-MULTIPLIER SECTION AMPLIFIES THE SIGNAL BY ABOUT 10 MILLION. THE CAMERA IS USED IN THE LINE SCAN MODE WITH THE SPACECRAFT MOTION ALONG THE ORBITAL TRACK PROVIDING THE OTHER SCAN COMPONENT. NO SHUTTER IS REQUIRED AS THE SENSOR IS A NON-STORAGE TYPE, AND EXPOSURE TO THE SCENE IS CONTINUOUS. THE VERY NARROW BANDWIDTH (1800 HZ) RESULTS IN GENERATION OF A VIDEO SIGNAL WITH THE HIGH NOMINAL S/N OF 40 DB. THE CAMERA-LINE FREQUENCY IS 4 HZ WITH THE FRAME PERIOD BEING 200 SEC. THE LENS APERTURE IS FIXED AT F/3. THE GROUND RESOLUTION IS 1.7 NM AT THE SUBSATELLITE POINT. REALTIME PICTURES CAN BE TRANSMITTED TO APT RECEIVING STATIONS.		LIGHT REFLECTED FROM THE EARTH'S SURFACE AND CLOUD COVER		100 TO 10,000 FOOT-LAMBERTS		800 TV LINE RESOLUTION, S/N=40 DB AT 10,000 FOOT-LAMBERTS			

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
0.4 TO 0.7 MICRON					
39. FIELD OF VIEW		40. GROUND SWATH			
92.0 BY 7.0 DEG		1300 NM BY 80 NM FROM 600 NM ALTITUDE			
41. ANGULAR RESOLUTION		42. SPATIAL RESOLUTION			
0.16 DEG		1.7 NM AT CENTER FROM 600 NM ALTITUDE			
43. POINTING ACCURACY		44. POINTING RATE		45. INCINERATION	
				MED CIRCULAR SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
SPACECRAFT ATTITUDE ERRORS MUST BE HELD TO VERY SMALL VALUES					
47. COMPONENTS					
IMAGE DISSECTOR, SCANNING APERTURE, 12 STAGE ELECTRON MULTIPLIER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
14 LB		0.2 CU FT		12 WATTS	
51. INTERFERENCE		52. INTERFERENCE		53. SHIELDING	
SENSITIVE					
54. CALIBRATION		55. DATA RECOVERY		56. FREQUENCY OF OBSERVATION	
				DELAYED AND REALTIME 14 PICTURES/ORBIT	
57. TELEMETRY REQUIREMENTS					
1 VIDEO CHANNEL (1800 HZ BANDWIDTH), 12 HOUSEKEEPING CHANNELS					
58. ADVANTAGES AND LIMITATIONS					
HAS APT CAPABILITY; DAYLIGHT USE ONLY.					
59. REFERENCES					
1) FRANKLIN, W., IDCS SUBSYSTEM DIRECTORY (REVISED). **2) MINZNER, R. A.: INTERIM REPORT ON SATELLITE METEOROLOGY INSTRUMENTS. NASA/ERC REPORT NO. PM-6713, JUNE 1967.					
60. HISTORICAL REMARKS					
REPLACES AVCS PLUS APT. FLOWN ON ATCS 3 AND NIMBUS 3.					
61. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE <b>INFRARED INTERFEROMETER/SPECTROMETER</b>		2. ACRONYM <b>IRIS</b>		3. EXP NO <b>11/10/69 0005</b>					
(TITLE CONT.)		4. RESUME DATE		5. VERSION DATE					
6. PRINCIPAL INVESTIGATOR <b>HANEL, R.A.</b>		7. ORGANIZATION <b>GODDARD SPACE FLT CENTER 301-982-4528</b>		8. TELEPHONE					
9. CO-INVESTIGATOR <b>CONRATH, DR. B.</b>		10. ORGANIZATION <b>GODDARD SPACE FLT CENTER 301-982-4235</b>		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. STATUS DATE		16. STATUS DATE	
18. MONITOR <b>SCHARDT, B. B.</b>		19. AGENCY <b>NASA HQ/RTS</b>		20. PGM OFFICE <b>OSSA/SRN 202-962-0891</b>		21. TELEPHONE		22. LEAD TIME	
23. VENDOR <b>TEXAS INSTRUMENTS</b>		24. LOCATION <b>DALLAS, TEXAS</b>		25. DATE <b>03/70</b>		26. INSTRUMENT TYPE <b>SPECTROMETER, MODIFIED NICHOLSON INFRARED INTERFEROMETER</b>		27. UNCLAS	
28. APPLICATION <b>NET</b>		29. SPACECRAFT <b>NIMBUS D</b>		30. PURPOSE					
<p>PRIMARY- TO DETERMINE THE VERTICAL TEMPERATURE PROFILE, VERTICAL OZONE DISTRIBUTION, VERTICAL WATER VAPOR DISTRIBUTION, AND TEMPERATURE OF EARTH'S SURFACE OR CLOUD TOPS.</p>									
<p>31. PRINCIPLES OF OPERATION THIS IS A THYMAN-GREEN MODIFICATION OF A NICHOLSON INTERFEROMETER SPECTROMETER OPERATING IN THE 6.5 TO 40 MICRON WAVELENGTH REGION. RADIATION FROM A CYLINDER OF ATMOSPHERE, WHOSE BASE ON THE SURFACE OF THE EARTH IS A CIRCLE OF 53 NM IN DIAMETER, IS REFLECTED INTO THE INSTRUMENT FROM A PLANE MIRROR WHICH ROTATES TO PROVIDE IMAGE MOTION COMPENSATION. THE RADIATION IS SPLIT INTO 2 BEAMS, ONE OF WHICH IS REFLECTED FROM A MOVING MIRROR, RECOMBINED AND FOCUSED ONTO A BOLOMETER DETECTOR. INTERFERENCE EFFECTS RESULT FROM THE PATH LENGTH DIFFERENCES IN THE TWO BEAMS AS THE MIRROR MOVES. IT TRAVELS ABOUT 2 MM IN 13 SEC TO GIVE AN INTERFEROGRAM WHICH IS RECORDED ON TAPE. OBSERVATIONS ARE BEGUN 16 SEC APART IN WHICH TIME THE S/C TRAVELS ABOUT 65 NM THUS THERE IS NO OVERLAP IN SUCCESSIVE OBSERVATIONS. AFTER RECORDING 14 INTERFEROGRAMS, TWO CALIBRATION OBSERVATIONS ARE MADE, ONE FOR A REFERENCE BLACKBODY AT 300 K AND ONE FOR OUTER SPACE. A FOURIER TRANSFORMATION, PERFORMED BY DIGITAL COMPUTER MUST BE MADE ON EACH TELEMETERED INTERFEROGRAM TO PRODUCE A SPECTRUM. THEN, TO RELATE THIS TO ATMOSPHERIC CONDITIONS APPROPRIATE SPECTRAL ABSORPTION REGIONS MUST BE CHOSEN AND EMPLOYED IN AN INVERSION OF THE RADIATIVE TRANSFER EQUATIONS.</p>									
32. PHENOMENA OBSERVED									
REFLECTED AND EMITTED IR ENERGY FROM EARTH AND ITS ATMOSPHERE									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
TEMPERATURE TO 2 DEG K; TOTAL WATER VAPOR AND SCALE HEIGHT 5%									

35. SPECTRAL RANGE <b>6.5 TO 40.0 MICRONS</b>		36. SPECTRAL RESOLUTION <b>0.32 PERCENT</b>		37. TIME CONSTANT <b>3. MILLSEC</b>	
38. FIELD OF VIEW <b>5. DEG</b>		39. GROUND SWATH <b>53 NM DIAM CIRCLE FROM 600 NM ALTITUDE</b>			
40. ANGULAR RESOLUTION <b>5. DEG 53 NM FROM 600 NM ALTITUDE</b>		41. SPATIAL RESOLUTION <b>5. DEG 53 NM FROM 600 NM ALTITUDE</b>			
42. POINTING ACCURACY <b>44. ALTITUDE</b>		43. POINTING RATE <b>45. INCLINATION</b>			
46. SPECIAL REQUIREMENTS <b>MED CIRCULAR SUN-SYNCH RETROGRADE</b>		47. COMPONENTS <b>INTERFEROMETER SPECTROMETER, ELECTRONICS</b>			
48. WEIGHT <b>38 LB</b>		49. VOLUME <b>0.3 CU FT</b>		50. AVERAGE POWER <b>12 WATTS</b>	
51. INTERFERENCE <b>52. INTERFERENCE</b>		53. INTERFERENCE <b>54. INTERFERENCE</b>		55. INTERFERENCE <b>56. INTERFERENCE</b>	
57. DATA RECOVERY <b>SENSITIVE</b>		58. FREQUENCY OF OBSERVATION <b>CONTINUOUS</b>			
59. CALIBRATION <b>BLK BODY AND COLD SPACE</b>		60. TELEMETRY REQUIREMENTS <b>3.75 K-BITS PER SECOND FOR 13 OUT OF 16 SECONDS</b>			
61. ADVANTAGES AND LIMITATIONS <b>NO INFORMATION WITH SOLID CLOUD COVER, LIMITED INFORMATION WITH PARTIAL CLOUD COVER, IMC REQUIRED, MOVING PARTS</b>		62. REFERENCES <b>1) MINZNER, R.A. ED.; INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, NASA-ERC PM-6713, JUNE 1967.***2) SILVER, J.: IRIS SUBSYSTEM DIRECTORY, GENERAL ELECTRIC CO., PHILADELPHIA, PA., JUNE 1968.***3) GOLDBERG, I.L.: METEOROLOGICAL IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL SYMPOSIUM OF SPIE, AUG. 68.</b>			
63. HISTORICAL REMARKS		64. REFERENCES			
65. HISTORICAL REMARKS		66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
INTERROGATION, RECORDING, AND LOCATION SYSTEM (TITLE CONT.)			IRLS						
4. RESUME	5. V-HOUR		11/10/69 0005						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
COTE, C. E.	GODDARD SPACE FLT CENTER		301-982-4104						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
NONE	13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		17. STATUS		
12. OBJECT TYPE							PROTOTYPE		
18. MONITOR	19. AGENCY		20. PGM OFFICE		21. TELEPHONE		27. SECURITY		
SCHARDT, B. B.	NASA HDOTRS		OSSA/SRN		202-962-0891		28. APPLICATION		
22. VENDOR	23. LOCATION		24. DATE		25. LEAD TIME		29. SPACECRAFT		
RADIATION, INC.	MELBOURNE, FLORIDA		03/70				NIMBUS D		
26. INSTRUMENT TYPE									
TRANSPONDER, UHF									
28. APPLICATION									
NET, COMM									
30. PURPOSE									
PRIMARY- TO LOCATE SUCCESSIVE POSITIONS OF EACH UNIT OF A SET OF IN-SITU DATA-GATHERING MODULES (E.G., THE BALLOON INTERROGATION PACKAGE (BIP)): TO RECEIVE AND STORE IN THE S/C THE DATA MEASURED BY EACH MODULE; TO TRANSMIT THE STORED DATA TO A GROUND STATION FOR PROCESSING. THE OBJECTIVE IS TO ESTABLISH A WORLD-WIDE NET FOR OBTAINING WIND AND OTHER METEOROLOGICAL DATA.									
31. PRINCIPLES OF OPERATION									
THIS INSTRUMENT IS SIMILAR TO THAT FLOWN ON NIMBUS 3. IT CONSISTS OF A TRANSMITTER (401.5 MHZ) WITH A SOLID STATE FINAL STAGE, RECEIVER (466 MHZ), DECODING AND CODING CIRCUITS, RANGE DETECTOR AND MEMORY (100 KBIT). THE DATA MODULES EACH WITH A UNIQUE ADDRESS, OF WHICH THE BALLOON INTERROGATION PACKAGE (BIP) IS AN EXAMPLE, CONTAIN A RECEIVER (401.5 MHZ), DECODING AND CODING CIRCUITS, DATA SENSORS AND A TRANSMITTER (466 MHZ). AS THE S/C PASSES WITHIN RANGE OF A COMMAND AND DATA ACQUISITION STATION (CDA) UP TO 370 COMMANDS CAN BE SENT AND STORED IN THE IRLS MEMORY. A COMMAND CONSISTS OF A TIME FOR AN INTERROGATION AND THE ADDRESS OF THE BIP (OR OTHER MODULE) TO BE CONTACTED. WHEN THE STORED COMMAND TIME AND THE S/C CLOCK TIME COINCIDE, THE S/C IRLS TRANSMITS THE ASSOCIATED BIP ADDRESS. THE BIP RESPONDS AND TRANSMITS ITS SENSOR READINGS. THESE AND THE ROUND TRIP SIGNAL DELAY TIME BETWEEN THE BIP AND THE S/C ARE STORED IN THE IRLS MEMORY. THIS PROCEDURE IS REPEATED FOR EACH STORED COMMAND UNTIL THE CDA INITIATES TRANSMISSION OF THE MEMORY CONTENTS AND THE STORAGE OF NEW COMMANDS IN THE MEMORY. KNOWING THE S/C POSITIONS AND TWO RANGES TAKEN ABOUT 150 SEC APART, THE POSITION OF A MODULE CAN BE FOUND TO WITHIN 2 KM.									
32. PHENOMENA OBSERVED									
TRANSMISSIONS FROM REMOTE PLATFORMS-BALLOONS, BUOYS, SURFACE PKG									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
LOCATION TO +/-1.1 NM; DELAY TIME TO 0.625 MICROSEC									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
466. AND 401.5 MHZ	NA	
38. FIELD OF VIEW	39. GROUND SWATH	
NA	NA	
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
	MED CIRCULAR	SUN-SYNCH RETROGRADE
45. SPECIAL REQUIREMENTS		
47. COMPONENTS		
RECEIVER, TRANSMITTER, ELECTRONICS, MEMORY, ANTENNA		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
25 LB	3 CU FT	18 WATTS
51. STANDBY POWER	52. PEAK POWER	53. MTBF
		107 HATS
54. INTERFERENCE	55. INTERFERENCE	56. NUCLEAR THERMAL
		57. INTERFERENCE
58. SHIELDING		
SOURCE/SEN	60. DATA RECOVERY	
59. CALIBRATION	61. FREQUENCY OF OBSERVATION	
62. TELEMETRY REQUIREMENTS		
DELATED TELEMETRY ON COMMAND		
20 CHANNELS: 5 DIGITAL AND 15 ANALOG, SAMPLED BETWEEN 1 AND 16 SECONDS		
63. ADVANTAGES AND LIMITATIONS		
TOTAL BIP WEIGHT INCLUDING SOLAR-POWER SOURCE IS 10 POUNDS: BIPS NEAR THE EQUATOR MAY NOT RESPOND ON SUCCESSIVE ORBITS		
64. REFERENCES		
1) JONES, H., IRLS SUBSYSTEM DIRECTORY (PRELIM), GENERAL ELECTRIC CO., PHILADELPHIA, PA., FEB. 1968.***2) MINZNER, R.A.: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS NASA/ERC REPORT NO. PM-6713, JUNE 8, 1967.		
65. HISTORICAL REMARKS		
SIMILAR TO THE NIMBUS 3 IRLS		
66. DIAGRAMS		



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
MONITOR OF ULTRAVIOLET SOLAR ENERGY		NUSE		11/10/69		0004			
(TITLE CONT.)		4. NAME		5. VERSION					
		DATE		DATE					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
HEATH, DR. D. F.		GODDARD SPACE PLT CENTER		301-982-6421					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
TYPE								17. STATUS	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. PROTOTYPE	
SCHARDT, B. B.		NASA HDOTRS		LOSSA/SRN		202-962-0891			
23. VENDOR		24. LOCATION		25. LEAD TIME					
ADCOLE CORPORATION		WALTHAM, MASS.		03/70					
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION					
SPECTROMETER, 6-CHANNEL OPTICAL-FILTER PHOTODIODE		29. SPACECRAFT		UNC					
30. PURPOSE		31. NIMBUS D							
<p>PRIMARY-TO DETECT VARIATION OF RELATIVE INTENSITY OF SOLAR FLUX IN 5 SPECTRAL BANDS TO HELP DETERMINE THE DISTRIBUTION OF OZONE IN THE ATMOSPHERE.***SECONDARY- TO MAKE ABSOLUTE MEASUREMENTS OF THE FLUX, TO MEASURE THE RATE OF DECREASE OF FLUX AS THE SATELLITE ENTERS THE EARTH SHADOW NEAR THE POLES, TO MEASURE OZONE AND MOLECULAR OXYGEN HIGH IN THE ATMOSPHERE.</p> <p>THIS EXPERIMENT, SIMILAR TO ONE FLOWN ON NIMBUS B2, USES 6 PHOTODIODES TO MONITOR THE FLUX FROM THE SUN IN 6 WAVELENGTH REGIONS. THESE REGIONS ARE AT 1216 A (THE HYDROGEN LYMAN ALPHA LINE), 1400 A WITH A 100 A WIDTH, 1600 A WITH A 140 A WIDTH, 1800 A WITH A 300 A WIDTH, 2100 A WITH A 450 A WIDTH, AND 2600 A WITH A 600 A WIDTH. OPTICAL FILTERS DETERMINE THE SHORT WAVELENGTH CUTOFF FOR EACH REGION, AND THE CHOICE OF PHOTOCATHODE MATERIAL DETERMINES THE LONG WAVELENGTH CUTOFF. A SOLAR ASPECT SENSOR GIVES THE ANGLE AT WHICH THE SUN'S RAYS STRIKE THE DIODES WITH 7 BIT ACCURACY. USABLE DATA IS OBTAINED OVER A 100 DEG FOV. THE RADIATION INTENSITY IS READ AS THE CURRENT FROM THE PHOTO-DIODES BY EITHER OF 2 PARALLEL ELECTROMETERS WITH 4 DECADE RANGES. THERE IS AN AUTOMATIC ZERO SETTING DEVICE FOR THE ELECTROMETERS. THEY ARE CALIBRATED USING 5 CONSTANT CURRENTS SUPPLIED BY A RADIOACTIVE SOURCE (AM 241). AN EXPERIMENT CYCLE TAKES 48 SEC INCLUDING CALIBRATION CHECKS, HOUSEKEEPING CHECKS AND SENSOR DATA. EACH SENSOR IS MONITORED FOR 5 SEC PER CYCLE. THIS DATA WILL BE CORRELATED WITH DATA FROM THE BUW EXPERIMENT TO HELP UNDERSTAND THE SOLAR INFLUENCE ON THE STRATOSPHERE. THE ABSOLUTE ACCURACY OF THE MEASUREMENTS WILL BE 20 PERCENT.</p> <p>27. PHENOMENA OBSERVED</p> <p>ULTRAVIOLET SOLAR RADIATION FLUX</p> <p>33. MEASUREMENT RANGE</p> <p>SIGNAL CURRENT FROM 0.1 NANOAMP TO 100 NANOAMPS</p> <p>34. PRECISION AND ACCURACY</p> <p>ABSOLUTE ACCURACY OF FLUX MEASUREMENT WITHIN 20 PERCENT</p>									

35. SPECTRAL RANGE	1200. TO 2600. A	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH		
100. DEG			
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
0.7 DEG 7 NM FROM 600 NM ALTITUDE			
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
PHOTODIODE DETECTORS, ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
9 LB			
52. PEAK POWER	53. MTBF		
54. INTERFERENCE	55. MAGNETIC INTERFERENCE	56. NUCLEAR INTERFERENCE	57. THERMAL INTERFERENCE
58. SHIELDING			
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
CONSTANT CURRENTS	DELAYED TELEMETRY	25 MIN PER ORBIT	
62. TELEMETRY REQUIREMENTS			
30 BIT DIGITAL WORD READ ONCE EVERY SECOND AT 4 KBITS PER SEC.			
63. ADVANTAGES AND LIMITATIONS			
64. REFERENCES			
1) NORMYLE, W.J.: NIMBUS B TO TEST NEW WEATHER SENSORS. AVIATION WEEK AND SPACE TECHNOLOGY, MAY 6, 1968, PP. 71-79.***			
2) PRESS KIT NIMBUS B, NASA RELEASE NO: 68-48K, MAY 1968.***3			
FRANKLIN, W.: SUBSYSTEM DIRECTORY REVISED, GENERAL ELECTRIC CO., PHILADELPHIA, PA.			
65. HISTORICAL REMARKS			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
SATELLITE INFRARED SPECTROMETER (TITLE CONT.)	4. RESUME	5. VERSION							
14-CHANNEL	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
WARR, DR. D.Q.	NAT ENV SAT CTR, ESSA	301-440-7114							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
HILFARY, D.T.	NAT ENV SAT CTR, ESSA	301-440-7114							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. CONTRACT DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HDQTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
		03/70							
26. INSTRUMENT TYPE	SPECTROMETER, 14-CHANNEL IR FASTIE-EBERT FIXED-GRATING								
28. APPLICATION	29. SPACECRAFT								
HET	NIMBUS D								
30. PURPOSE									
PRIMARY- TO DETERMINE THE WORLDWIDE 3 DIMENSIONAL DISTRIBUTION OF TEMPERATURE, FROM THE GROUND OR FROM CLOUD TOP TO AN ALTITUDE OF 16 TO 19 NM, TO MEASURE SURFACE TEMPERATURE OR THE CLOUD-TOP TEMPERATURE, AND ITS HEIGHT. TO MEASURE THE THREE-DIMENSIONAL DISTRIBUTION OF WATER VAPOR, FROM THE GROUND UP TO ABOUT 6.5 NM.									
31. PRINCIPLES OF OPERATION									
<p>THE INSTRUMENT, A MODIFICATION OF THE NIMBUS B2 SIRS, IS A FASTIE-EBERT FIXED-GRATING INFRARED SPECTROMETER WITH THE FOLLOWING FEATURES: (1) A PLANE, LIGHT-COLLECTING MIRROR TO PROVIDE ONE FIXED AND TWO VARIABLE EARTH-VIEWING ANGLES; (2) A BALANCED ROTATING CHOPPING MIRROR WHICH SERVES ALTERNATIVELY TO COLLECT SPACE RADIATION, AND EARTH RADIATION; (3) A SPHERICAL MIRROR OF 12.5-INCH FOCAL LENGTH; (4) A 2.5-INCH WITH 1250 LINES PER INCH DIFFRACTION GRATING; (5) A SET OF 14 EXIT SLITS WITH ASSOCIATED INTERFERENCE FILTERS FOR ORDER LIMITATION, AND 14 WEDGE-IMMERSED OR SIMILAR THERMISTOR BOLOMETERS; AND (6) A BLACKBODY RADIATION SOURCE FOR CALIBRATION PURPOSES. THE 15 MICRON RADIATION DATA IS TRANSFORMED INTO A SINGLE TEMPERATURE-PRESSURE PROFILE BY A MATHEMATICAL INVERSION TECHNIQUE. A SIMILAR RELATED TECHNIQUE YIELDS THE ALTITUDE PROFILE OF WATER VAPOR FROM THE 18 TO 35 MICRON DATA. THE 11.1 MICRON DATA COMPARED WITH A BLACKBODY TEMPERATURE CALIBRATION CURVE YIELDS SURFACE OR CLOUD-TOP TEMPERATURES. THE BANDS MONITORED ARE CENTERED AT 11.12, 13.33, 14.01, 14.16, 14.31, 14.45, 14.76, 14.95, 18.82, 22.91, 23.50, 34.31, 33.11, 35.71 MICRONS. DATA IS ACCUMULATED IN 6 SEC INTERVALS TO GIVE PROFILES EACH 50 MILES ALONG THE STRIP.</p>									
32. PHENOMENA OBSERVED									
IR RADIATION EMITTED FROM THE EARTH'S ATMOSPHERE.									
33. MEASUREMENT RANGE									
40 TO 190 ERG/SEC/SQ-CH/STERADIAN/WAVE-NO									
34. PRECISION AND ACCURACY									
TEMPERATURE PLUS-NINUS 1 DEG K, WATER VAPOR TO +-1 PERCENT.									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
11.1 TO 36.0 MICRONS	0.6 PERCENT	5.0 SECONDS
38. FIELD OF VIEW	39. GROUND SWATH	
32.0 BY 12.5 DEG	350 NM BY 130 NM FROM 600 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
12.5 DEG	130 NM FROM 600 NM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	MED CIRCULAR	SUN-SYNCH RETROGRADE
47. COMPONENTS		
SPECTROMETER, MIRRORS, BOLOMETERS, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
70 LB	2.3 CU FT	30 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. INTERFERENCE
SENSITIVE	SENSITIVE	SENSITIVE
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
SEE ITEM 31	DELAYED TELEMETRY	CONTINUOUS
62. TELEMETRY REQUIREMENTS		
15 CHANNELS, ALL SAMPLED WITHIN 100 MJSPEC EVERY 2-8 SECONDS.		
9 BIT ACCURACY		
63. ADVANTAGES AND LIMITATIONS		
MOVING PARTS		
64. REFERENCES		
1) GALOPP, D.E., SIRS B SUBSYSTEM DIRECTORY (PEPELIM), GENERAL ELECTRIC CO., PHILADELPHIA, PA., DEC. 1967.***2) GOLDBERG, I.: METEOROLOGICAL IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANNUAL TECH SYMP OF SPIE, AUG 1968.***3) MINZNER, R.A. (ED): INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS. NASA/ERC PH-6713, JUNE 1967.		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
SELECTIVE CHOPPER RADIOMETER		SCR							
(TITLE CONT.)		4. NAME		5. VERSION					
		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
HOUGHTON, DR. J. AND		OXFORD UNIVERSITY, ENG.		05-9291					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
SMITH, DR. S./JOINT PI		READING UNIVERSITY, ENG.		888-4372					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. DATE					
				15. DATE					
16. MONITOR		17. STATUS		18. DATE					
19. AGENCY		20. PGM OFFICE		21. TELEPHONE					
SCHARDT, B. B.		NASA HDOTRS		202-962-0891					
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
				03/70					
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT			
RADIOMETER, 3 DUAL-CHANNEL INFRARED						NITBUS D		UNC	
30. PURPOSE									
<p>PRIMARY- TO DETERMINE THE THREE-DIMENSIONAL TEMPERATURE STRUCTURE OF THE EARTH'S ATMOSPHERE THROUGH THE USE OF THE 15 MICRON ABSORPTION BAND OF CO2 ON A GLOBAL BASIS BETWEEN THE GROUND OR HIGHEST CLOUD TOP AND 50-KM ALTITUDE.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE INSTRUMENT HAS 6 CHANNELS, EACH WITH A FIELD-OF-VIEW OF 10 DEG AND ARE ARRANGED IN 3 UNITS OF 2. THE BASIC SPECTRAL SELECTION IS ACHIEVED BY INTERFERENCE FILTERS OF 2 TYPES. THREE CHANNELS USE FILTERS 4 INV. CM. WIDE, AND 3 USE FILTERS 10 INV. CM. WIDE. FOR THE NARROW BAND CHANNELS, A TECHNIQUE OF SELECTIVE CHOPPING BY CO2 IS USED TO FURTHER DELINEATE THE ENERGY COLLECTED. THE FILTERED RADIATION IS SWITCHED BETWEEN A CELL CONTAINING CO2 AND AN EMPTY CELL. THIS PERMITS ONLY WAVELENGTHS ABSORBED BY CO2 TO BE CHOPPED. BY THIS MEANS, THE ENERGY COLLECTED IS EQUIVALENT TO THAT FROM AN INTERVAL OF 1.3 INV. CM. IN 2 OF THE NARROW CHANNELS THE WEIGHTING FUNCTION IS FURTHER SHARPENED BY ADDING A SMALL AMOUNT OF CO2 AT VERY LOW PRESSURE TO THE EMPTY CELL. TEMPERATURES CAN BE OBTAINED UP TO HEIGHTS OF 27 NM USING THE WEIGHTING FUNCTIONS. FOR LOWER ALTITUDE MEASUREMENTS HEIGHT RESOLUTION IS INCREASED FOR THE REMAINING 1 NARROW AND 3 BROAD CHANNELS BY USING A SINGLE CO2 CELL TO ABSORB THE CENTRAL PORTIONS OF THE LINES. THE OPTICAL SYSTEM CONSISTS OF A MOVABLE MIRROR, CHOPPERS, GERMANIUM LENSES, FILTERS, AND A LIGHT PIPE TO CONDENSE RADIATION ONTO A THERMISTOR BOLOMETER. THE OUTPUT OF EACH CHANNEL IS SAMPLED ONCE EACH SECOND.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>IR RADIATION EMITTED FROM THE EARTH'S ATMOSPHERE</p>									
<p>33. MEASUREMENT RANGE</p>									
<p>34. PRECISION AND ACCURACY</p> <p>TEMPERATURE TO <math>\pm 1</math> DEG C., ALTITUDE TO <math>\pm 100</math> METERS</p>									

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
14.5 TO 15.0 MICRONS		0.2 PERCENT			
39. FIELD OF VIEW		40. GROUND SWATH			
10.		DEG 81 NM DIAM CIRCLE FROM 600 NM ALTITUDE			
41. ANGULAR RESOLUTION		42. SPATIAL RESOLUTION			
10.		DEG 81 NM FROM 600 NM ALTITUDE			
43. POINTING ACCURACY		44. POINTING RATE		45. INCLINATION	
		MED CIRCULAR		SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
THIS DATA REQUIRED FOR CALCULATIONS OF VERTICAL TEMP PROFILES					
47. COMPONENTS					
3 RADIOMETERS, MIRROR, DETECTOR, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
34 LB.		0.5 CU FT		51. STANDBY POWER	
		5 WATTS		52. PEAK POWER	
		5 WATTS		53. NTBF	
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
57. CALIBRATION		58. DATA RECOVERY		59. FREQUENCY OF OBSERVATION	
		SENSITIVE		CONTINUOUS	
SPECIFIC SEQUENCES					
60. TELEMETRY REQUIREMENTS					
61. DELAYED TELEMETRY					
62. CHANNELS SAMPLED ONCE EACH SECOND WITH ONE-HALF PERCENT ACCURACY					
63. ADVANTAGES AND LIMITATIONS					
BETTER SPECTRAL RESOLUTION THAN CONVENTIONAL SPECTROMETERS OR INTERFEROMETERS. LIMITED TO ABOVE CLOUDS.					
64. REFERENCES					
1) SMITH, B.W., SCR SUBSYSTEM DIRECTORY (PRELIM) GENERAL ELECTRIC CO., PHILADELPHIA, PA., FEBRUARY 1968.***2) MINZNER, R.A.: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS. NASA/ERC REPORT NO. PN-6713, JUNE 1967.***3) GOLDBERG, I.L.: NET IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANN TECH SYMP OF SPIE, AUG. 19, 1968.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
TEMPERATURE/HUMIDITY INFRARED RADIOMETER	THIR								
(TITLE CONT.)	4. RESUME	5. VERSION							
	11/10/69	0004							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
MCULLOCH, A. W.	GODDARD SPACE	301-982-4347							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
GOLDBERG, I. L.	GODDARD SPACE	301-982-4347							
12. CONTRACT	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. GOVT. ORDER	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA	HDOTRS	OSSA/SRN 202-0891						
22. VENDOR	23. LOCATION	24. FLIGHT	25. LEAD TIME						
		03/70							
26. INSTRUMENT TYPE	27. ACRONYM								
RADIOMETER, 2-CHANNEL IR HIGH-RESOLUTION SCANNING	UNC								
28. APPLICATION	29. SPACECRAFT								
MET, ERSP	NIMBUS D								
30. PURPOSE									
PRIMARY-TO PROVIDE NIGHT AND DAY TIME RESOLUTION, IR TEMPERATURE MAPS OF CLOUDS, LAND, AND OCEAN SURFACE OF THE EARTH.***SECONDARY- TO PROVIDE SYNOPSIS HUMIDITY PATTERNS. TO TRY TO TRACE AIR MASS BOUNDARIES, VERTICAL MOTIONS AND JET STREAMS.***TERTIARY- TO PROVIDE SUPPORTING DATA FOR OTHER EXPERIMENTERS.									
31. PRINCIPLES OF OPERATION									
THIS RADIOMETER LIKE THE HRIR IS A SCANNING RADIOMETER. THE SCAN IS ACCOMPLISHED BY A PLANE MIRROR ROTATING AT 48 RPM. RADIATION FROM THE SCANNING MIRROR IS COLLECTED AND FOCUSED BY A CASSEGRAIN TELESCOPE WITH A 5 INCH PRIMARY MIRROR. A DICHOIC BEAM SPLITTER AND FILTERS THEN DIVIDE THE BEAM INTO 2 CHANNELS, A 6.5-7.0 MICRON CHANNEL FOR WATER VAPOR MEASUREMENTS AND A 10.5-12.5 MICRON CHANNEL FOR SURFACE OR CLOUD TOP TEMPERATURE MEASUREMENTS. IMMERSED THERMISTOR BOLOMETERS ARE THE DETECTORS IN BOTH CHANNELS. DURING A SCAN PERIOD OF 1.25 SEC, THERE IS A SYNC SIGNAL, A STEPPED VOLTAGE CALIBRATION SIGNAL, A SCAN OF COLD SPACE FOR A ZERO LEVEL, THE SCAN OF EARTH, ANOTHER SPACE SCAN, AND A HOUSING SCAN TO GIVE A WARM BODY CALIBRATION POINT. THERE IS NO RADIATION CHOPPING IN THIS INSTRUMENT. THE SWEEP RATE AND THE FIELD OF VIEW ARE CHOSEN SO THAT CONTIGUOUS SCANNING OCCURS ALONG THE SUBSATELLITE TRACK WITH INCREASING OVERLAP TOWARD THE HORIZON. THE 11 MICRON CHANNEL HAS A 0.4 DEG (7.0 MILLIRAD) FOV WHICH GIVES A 4.2 NM RESOLUTION FROM A 600 NM ORBIT. THE 6-MICRON CHANNEL HAS A 1.2 DEGREE (21 MILLIRADIANS) FIELD OF VIEW GIVING A 12.6 NM RESOLUTION FROM A 600 NM ORBIT.									
32. PHENOMENA OBSERVED									
IR RADIATION FROM THE EARTH'S SURFACE AND CLOUDS									
33. MEASUREMENT RANGE									
185 TO 300 DEG KELVIN									
34. PRECISION AND ACCURACY									
+-7 K DEG									

36. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
6.5 TO 12.5 MICRONS		2.0 MILLISEC
38. FIELD OF VIEW	39. GROUND SWATH	
SEE ITEM 31	LIMB-TO-LIMB (3800 NM) FROM 600 NM ALT	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
SEE ITEM 31	SEE ITEM 31	
42. POINTING ACCURACY	43. POINTING RATE	45. INCLINATION
1.0 DEG	MED CIRCULAR	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS		
47. COMPONENTS		
INTERFERENCE FILTER RADIOMETER, ELECTRONICS, MIRRORS, TELESCOPE		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
20 LB	0.5 CU FT	9 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. INTERFERENCE	58. INTERFERENCE	59. SHIELDING
60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
62. TELEMETRY REQUIREMENTS	BLK BODY AND COLD SPACE DELAYED AND REALTIME CONTINUOUS	
630 HZ INFORMATION BANDWIDTH		
63. ADVANTAGES AND LIMITATIONS		
BETTER S/N THAN HRIR, CAN GIVE CIRRUS CLOUD CONTENT: LIMITED TO CLOUD-TOP DATA		
64. REFERENCES		
1) KAHN, W.: THIR SUBSYSTEM DIRECTORY (PRELIM), GENERAL ELECTRIC CO., NOV. 1967.***2) GOLDBERG, I.L., METEOROLOGICAL INFRARED INSTRUMENTS FOR SATELLITES. GIVEN AT 13TH ANNUAL TSC. SYMP. OF SOC. PHOTO-OPTICAL ENGR., AUG 19-23, 1968.***3) NIMBUS D EXPERIMENT-ER PROGRAM REVIEW, 25-26 OCT. 1967.		
65. HISTORICAL REMARKS		
SIMILAR TO HRIR		
66. DIAGRAMS		

NIMBUS E

INSTRUMENT RESUME				
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS				
1. TITLE	2. ACRONYM	3. EXP NO		
ELECTRICALLY-SCANNING MICROWAVE RADIOMETER (TITLE CONT.)	ESMR	E12		
4. NAME	5. VERSION			
11/10/69	0005			
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE		
NORDBERG, DR. W.	GODDARD SPACE FLT CENTER	301-982-5003		
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE		
THADDEUS, DR. P.	GODDARD INST SPACE SCI	212-866-3600		
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. STATUS		
01/69	01/69	PRELIM DSGN		
15. MONITOR	16. AGENCY	17. TELEPHONE		
SCHARDT, B. B.	NASA HQTRS	202-962-0891		
22. VENDOR	23. LOCATION	24. DATE		
SPACE GENERAL CORP	EL MONTE, CALIFORNIA	06/72 30 MONTHS		
25. INSTRUMENT TYPE	26. APPLICATION	27. SPACECRAFT		
RADIOMETER, 19.35-GHZ ELECTRONICALLY-SCANNING MICROWAVE	UNC	NIMBUS E		
31. PRINCIPLES OF OPERATION				
<p>THE RADIOMETER WILL BE USED TO MEASURE PRECISELY THE INTENSITY OF 19.35 GHZ THERMAL RADIATION. THE VIEWING DIRECTION OF THE ANTENNA IS ELECTRONICALLY SCANNED PLUS AND MINUS 50 DEGREES FROM THE NADIR NORMAL TO THE SPACECRAFT GROUND TRACK, PRODUCING A BRIGHTNESS TEMPERATURE MAP OF THE SURFACE OF THE EARTH AND ITS ATMOSPHERE UNDER THE SPACECRAFT. THIS SCANNING CONSISTS OF 78 DISCRETE VIEW POSITIONS AND IS CONTROLLED BY AN INTERNAL COMPUTER. ANGULAR SEPARATION OF VIEW POSITIONS ALLOWS AN 8.5 PERCENT OVERLAP. THE ANTENNA THERMAL TEMPERATURE MUST BE MEASURED. CALIBRATION IS ACHIEVED WITH TWO REFERENCE SOURCES, ONE AT 338 DEGREES KELVIN, THE OTHER NEAR 50 DEGREES KELVIN (A SPACE-VIEWING HORN). THE 90 BY 90 CENTIMETER ANTENNA IS DEPLOYED AFTER ORBIT IS ACHIEVED. THE ANGULAR RESOLUTION OF THE ANTENNA WILL BE 1.4 DEGREES AT THE 3 DB POINTS AT THE BROADSIDE SETTING AND 1.5 DEGREES AT THE MAXIMUM SCAN POSITIONS OF PLUS AND MINUS 50 DEGREES.</p>				
32. PHENOMENA OBSERVED				
HORIZONTALLY POLARIZED TELLURIC THERMAL EMISSIONS AT 19.35 GHZ.				
33. MEASUREMENT RANGE				
DYNAMIC TEMPERATURE RANGE= 50 TO 330 DEGREES K				
34. PRECISION AND ACCURACY				
RHS TEMP WITHIN 0.5 DEG K; ABSOLUTE TEMP WITHIN 2 DEG K				

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
19.35	GHZ	3.10 PERCENT
38. FIELD OF VIEW	39. GROUND SWATH	
100. BY	1.4 DEG 1400 KM BY 15 KM FROM 600 KM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
1.4 DEG	17 KM FROM 600 KM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	47. COMPONENTS	SUN-SYNCH RETROGRADE
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
55 LB	1.4 CU FT	25 WATTS
51. STANDBY POWER	52. PEAK POWER	53. MTBF
NA	NA	NA
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. INTERFERENCE	58. SHIELDING	
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
SENSITIVE SENSITIVE NONE	SENSITIVE INTEGRAL	
TWO REFERENCE SOURCES	DELAYED TELEMETRY	CONTINUOUS
62. TELEMETRY REQUIREMENTS		
10 BIT WORD READ EACH 25 MILLISECONDS. SERIAL READOUT.		
63. ADVANTAGES AND LIMITATIONS		
HIGH SPATIAL RESOLUTION: ANTENNA SIDELOBE SUPPRESSION TO EXCEED 95 PERCENT. ANTENNA DESIGN AND DEPLOYMENT MOST CRITICAL.		
64. REFERENCES		
1) NORDBERG, W.: PROPOSAL FOR MAPPING EARTH RADIATION AND CLOUD STRUCTURE WITH AN ELECTRICALLY SCANNING MICROWAVE RADIOMETER, GSFC.***2) CATOE, ET AL: PRELIMINARY RESULTS FROM AIRCRAFT FLIGHT TESTS OF AN ELECTRICALLY SCANNING MICROWAVE RADIOMETER, NASA X-622-67-352, AUG 67.***3) TOBIN, M.: SUPPORT DATA FOR CONVALR 930 NET FLIGHT 2, NASA X-622-67-450, SEP 67.		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO.							
INFRARED TEMPERATURE-PROFILE RADIOMETER (TITLE CONT.)	TPPR	E06							
4. RESUME	5. VENDOR								
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SMITH, W. L.	ENVIRON SCI SERV ADMIN								
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
WARK, D. O.	ENVIRON SCI SERV ADMIN								
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHART, B.	NASA	HDOTRS							
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
SANTA BARBARA RES CENTER	GOLETA, CALIFORNIA		40 MONTHS						
26. INSTRUMENT TYPE									
RADIOMETER, 6-CHANNEL STEP-SCANNING INFRARED (MODIFIED MRIR)									
28. APPLICATION	29. SPACECRAFT								
RET	NIMBUS E								
30. PURPOSE									
PRIMARY- TO TEST AN IR RADIOMETER WHICH IS DESIGNED TO MEET THE ENGINEERING AND SCIENTIFIC DEMANDS OF AN OPERATIONAL REMOTE TEMPERATURE SOUNDER**SECONDARY-TO DEVELOP A TECHNIQUE FOR DERIVING THREE-DIMENSIONAL TEMPERATURE AND MOISTURE OF THE ATMOSPHERE FOR OPERATIONAL FORECASTS BY THE MID 1970'S.									
31. PRINCIPLES OF OPERATION	<p>THE INSTRUMENT IS BEING DESIGNED ALONG THE GENERAL LINES OF THE NIMBUS 2 MEDIUM RESOLUTION INFRARED RADIOMETER (MRIR). IT WILL MEASURE INFRARED RADIATION EMITTED FROM THE EARTH IN FOUR SPECTRAL INTERVALS IN THE 15-MICRON CARBON-DIOXIDE BAND, ONE INTERVAL IN THE ROTATIONAL WATER VAPOR BAND AND ONE INTERVAL IN THE 11.1-MICRON WINDOW. IT WILL VIEW THE EARTH SUCCESSIVELY AT 29 DIFFERENT VIEWING ANGLES DISTRIBUTED SYMMETRICALLY ABOUT EITHER SIDE OF THE NADIR AND IN A PLANE PERPENDICULAR TO THE SUB-ORBITAL TRACK. 29 GEOGRAPHICALLY INDEPENDENT RESOLUTION ELEMENTS WILL BE MEASURED IN A SINGLE STRIP. AS THE SATELLITE ORBITS, THE RADIOMETER WILL SAMPLE 29 OF THESE STRIPS AND THUS FORM A 29 X 29 MATRIX CONSISTING OF 841 INDEPENDENT RESOLUTION ELEMENTS. THE DATA FROM THIS 29 X 29 MATRIX WILL THEN BE USED TO DERIVE THE THREE DIMENSIONAL TEMPERATURE AND MOISTURE STRUCTURE FOR THAT AREA BY INVERTING THE RADIATIVE TRANSFER EQUATION USING NUMERICAL AND MATHEMATICAL TECHNIQUES. THE STATISTICAL FLUCTUATIONS OF THE RADIATION DATA FROM THE INDEPENDENT RESOLUTION ELEMENTS WILL BE UTILIZED IN THE SOLUTION TO ACCOUNT FOR THE ATTENUATION OF THE MEASURED RADIATION BY CLOUDS. THE DATA ACQUISITION PERIOD FOR EACH FRAME WILL BE ABOUT 4.1 MINUTES.</p> <p>32. PHENOMENA OBSERVED</p> <p>IR ENERGY EMITTED FROM THE SURFACE AND ATMOSPHERE OF THE EARTH</p> <p>33. MEASUREMENT RANGE</p> <p>0 - 200 ERG-CM/SQ-CM/SEC/STERADIAN</p> <p>34. PRECISION AND ACCURACY</p> <p>BETTER THAN 0.3 ERG-CM/SQ-CM/SEC/STERADIAN</p>								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
11.0	22.0	MICRONS
38. FIELD OF VIEW	39. GROUND SWATH	
74. BY	2.5	DEG 905 NM BY 26 NM FROM 600 NM ALTITUDE
40. ANGULAR RESOLUTION: SPATIAL RESOLUTION		
2.5	DEG 1.26 NM FROM 600 NM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		MED
45. SPECIAL REQUIREMENTS		
15 AUXILIARY TEMPERATURES AND VOLTAGES MONITORED		
47. COMMENTS		
RADIOMETER WITH ASSOCIATED OPTICS PLUS ELECTRONIC PACKAGE		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
35 LB	0.84 CU FT	25 WATTS
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE
55. CALIBRATION	56. DATA RECOVERY	57. FREQUENCY OF OBSERVATION
BLACK BODY; SPACE VIEW	DELATED TELEMETRY	CONTINUOUS
58. TELEMETRY REQUIREMENTS		
10-BIT CHANNEL; HOUSEKEEPING - 15 CHANNELS ONCE EVERY 1 TO 6 MINUTES WITH 1 PER CENT ACCURACY.		
59. ADVANTAGES AND LIMITATIONS		
OBSERVATIONS OVER BROKEN CLOUDS MAY BE USED TO DETERMINE TEMPERATURE PROFILE DOWN TO GROUND; MOVING PARTS.		
60. REFERENCES		
1) SMITH, W.L.: MEASUREMENT OF ATMOSPHERIC TEMPERATURE AND HUMIDITY PROFILES WITH AN INFRARED TEMPERATURE PROFILE RADIOMETER, ESSA PROPOSAL, FEB 69.***2) CHANEY, ET AL: TECH REPORT UNDER CONTRACT NASR-54(03).		
65. HISTORICAL REMARKS		
SIMILAR TO THE NIMBUS 2 MRIR.		
66. DIAGRAMS		

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### 63. ADVANTAGES AND LIMITATIONS



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	MICROWAVE SPECTROMETER		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			4. RESUME DATE	5. VERSION					
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
STELIN, DR. D.H.	MASS INST OF TECHNOLOGY		617-864-6900-X3711						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
BARATH, P. T. ET AL	JET PROPULSION LAB		213-354-3025						
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA DPOTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION								
JET PROPULSION LAB	PASADENA, CALIFORNIA	06/72 36 MONTHS							
24. INSTRUMENT TYPE									
RADIOMETER, 5-CHANNEL DICKE SUPERHETERODYNE MICROWAVE									
28. APPLICATION	29. SPACECRAFT								
NET	NIMBUS B								
30. PURPOSE									
<p>PRIMARY- TO DEMONSTRATE THE CAPABILITIES AND LIMITATIONS OF MICROWAVE SENSORS FOR MEASURING TROPOSPHERIC TEMPERATURE PROFILES, WATER VAPOR ABUNDANCE, AND CLOUD WATER CONTENT. ** SECONDARY - TO SUPPLEMENT IN SENSORS IN GATHERING DATA FOR WEATHER PREDICTION PURPOSES, ESPECIALLY OVER CLOUD-COVERED REGIONS OF THE EARTH.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE INSTRUMENT, VIEWING THE NADIR CONTINUOUSLY, WILL MEASURE THERMAL RADIATION AT FIVE WAVELENGTHS, 22.2, 31.4, 53.65, 60.82, AND 64.47 GHZ, NEAR THE 5-MM OXYGEN RESONANCE AND THE 1.35-CM WATER-VAPOR RESONANCE BANDS. EACH FREQUENCY IS AFFECTED TO A DIFFERENT DEGREE BY THE TERRESTRIAL SURFACE, CLOUDS, PRECIPITATION, WATER-VAPOR, AND TEMPERATURE PROFILE. THROUGH CAREFUL INTERPRETATION, MOST OF THESE METEOROLOGICAL PARAMETERS CAN BE SEPARATELY ESTIMATED. THE THREE CHANNELS NEAR 5-MM PRIMARILY MEASURE THE VERTICAL ATMOSPHERIC-TEMPERATURE PROFILE. THE TWO CHANNELS NEAR 1.0-CM BAND PERMIT WATER-VAPOR AND CLOUD-WATER CONTENT OVER THE OCEAN TO BE ESTIMATED SEPARATELY BECAUSE THE 0.9-CM CHANNEL IS ABOUT TWICE AS SENSITIVE TO CLOUDS AS THE 1.4-CM CHANNEL, BUT IS ONLY 0.4 TIMES AS SENSITIVE TO WATER-VAPOR. OVER LAND THE TWO WATER-VAPOR CHANNELS WILL YIELD AN ESTIMATE OF SURFACE TEMPERATURE ONCE THE SURFACE EMISSIVITY HAS BEEN CALIBRATED BY COMPARISON WITH DIRECT TEMPERATURE MEASUREMENTS. THE THREE OXYGEN RADIOMETERS SHARE A COMMON SIGNAL ANTENNA AND A COMMON REFERENCE ANTENNA. BOTH WATER-VAPOR RADIOMETERS HAVE THEIR OWN SIGNAL AND REFERENCE ANTENNAS. THE RADIOMETERS ARE CALIBRATED BY SEQUENTIAL OBSERVATION OF THE SIGNAL, REFERENCE, AND BLACK-BODY.</p>									
32. PHENOMENA OBSERVED									
ATMOSPHERIC AND SURFACE RADIATION IN THE 1-CM BANDS									
33. MEASUREMENT RANGE									
RADIANT TEMPERATURE FROM 0 TO 400 DEGREES KELVIN									
34. PRECISION AND ACCURACY									
TEMP-2 DEG K; WATER-VAPOR-0.1 GN/SQ CM; CLOUDS-0.04 GN/SQ CM									

35. SPECTRAL RANGE	0.466 TO 1.35 CM	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH		
9.0	DEG 100 NM DIAM CIRCLE FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
1.0 DEG	1.0 DEG/SEC MED	HIGH	
46. SPECIAL REQUIREMENTS			
CALIBRATION REFERENCE ANTENNAS MUST HAVE UNOBSTRUCTED SKY VIEW			
47. COMPONENTS			
RADIOMETERS (5), ANTENNAS (3 SETS), ASSOCIATED ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
50 LB	1.33 CU FT	35 WATTS	NONE
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. SHIELDING
SENSITIVE	SENSITIVE	SENSITIVE	-10 TO +65 DEG C
56. CALIBRATION	57. DATA RECOVERY	58. DATA RECOVERY	59. FREQUENCY OF OBSERVATION
REFERENCE, BLACK BODY	DELATED TELEMETRY	CONTINUOUS	
60. TELEMETRY REQUIREMENTS			
60 DPS			
63. ADVANTAGES AND LIMITATIONS			
TECHNIQUE IS NOT LIMITED TO SUN ANGLE CONSIDERATIONS OR CLOUD FORMATIONS.			
64. REFERENCES			
1) PROPOSAL FOR MICROWAVE SPECTROMETER, PER 68.***2) MEKES, M.L. AND LILLY, A.E.: J.G.R. V.68, P.1683, (1963).***3) LENOIR, W.B.: PHD THESIS MIT, (1965).***4) STAELIN, D.H.: J.G.R. V.71 P.2875 (1966).			
65. HISTORICAL REMARKS			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
POSITIVE-ION COMPOSITION SPECTROMETER (TITLE CONT.)	PICS	E31							
4. SOURCE	5. VERSION								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
TAYLOR, H.A.	GODDARD SPACE FLT CENTER	301-982-6610							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
BRINTON, H.C.	GODDARD SPACE FLT CENTER	301-982-4253							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
					PRELIM DSGN				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
SCHARDT, B.	NASA HDQTRS	OSSA/SRN	202-362-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
GODDARD SPACE FLT CENTER	GREENBELT, MARYLAND	21 MONTHS							
28. INSTRUMENT TYPE									
SPECTROMETER, BENNETT RADIO-FREQUENCY MASS									
29. SPACECRAFT									
PART-FLD NIMBUS B									
30. PURPOSE									
PRIMARY-TO INVESTIGATE THE GLOBAL ATMOSPHERIC ION COMPOSITION. EMPHASIS WILL BE PLACED ON THE INVESTIGATION OF MECHANISMS RESPONSIBLE FOR THE PRONOUNCED VARIABILITY OF THE COMPOSITION OF THE ATMOSPHERE. MAGNETIC STORM DATA IS OF PARTICULAR INTEREST. ** SECONDARY-TO EVALUATE ADVANCED MEASUREMENT TECHNOLOGY, IN THE FORM OF ON-BOARD PROCESSING OF COMPLEX ION SPECTRA.									
31. PRINCIPLES OF OPERATION									
A BENNETT RADIO FREQUENCY MASS SPECTROMETER WILL BE OPERATED IN EITHER OF TWO PRIMARY MODES FOR MEASURING THERMAL POSITIVE IONS: IN MODE A THE SPECTROMETER WILL SEARCH THE ENTIRE ION MASS RANGE (1-20 AMU) WITH A SWEEP PERIOD OF APPROXIMATELY 10 SECONDS. AS THE SPECTROMETER SWEEP VOLTAGE REACHES THE APPROPRIATE RESONANCE LEVEL, AMBIENT ATMOSPHERIC IONS OF A GIVEN MASS ARE SELECTIVELY PASSED THROUGH THE SPECTROMETER TUBE AND DETECTED IN THE FORM OF AN ANALOG ION CURRENT. THE COLLECTED ION CURRENT WILL BE AMPLIFIED BY A SERIES OF 5 DECADE AMPLIFIERS AND SUMMED INTERNALLY TO PRODUCE A SINGLE, LOGARITHMIC CHANNEL, WHICH CONSTITUTES THE PRIMARY ANALOG DATA OUTPUT FROM THE EXPERIMENT. A SECOND, NEARLY SIMULTANEOUS DIGITAL DATA OUTPUT IS DERIVED FROM A "DIGITAL PEAK DETECTOR" WHICH INTERROGATES THE LOGARITHMIC ANALOG CHANNEL ONCE EACH SECOND. TO DETERMINE (A) THE AMPLITUDE AND (B) THE SWEEP VOLTAGE 'POSITION' OF THE MOST PROMINENT ION PEAKS. IN MODE B, THE SELECTIVE SWEEP MODE, THE SPECTROMETER WILL SEARCH ANY ONE OF THREE SEPARATE SPECTRAL REGIONS, WHICH WILL BRACKET THE SWEEP LOCATIONS OF 1 AMU (H+), 4 AMU (HE+), AND 14 AND 16 AMU (N+ AND O+). THE PERIOD OF THE SELECTIVE SWEEP WILL BE APPROXIMATELY 2 SECONDS.									
32. PHENOMENA OBSERVED									
THERMAL POSITIVE IONS IN THE UPPER ATMOSPHERE									
33. MEASUREMENT RANGE									
MASS RANGE=1-20 AMU; SENSITIVITY FROM 10 TO 1,000,000 IONS/CU CM									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
1. TO 20.	1 IN 20 AMU	
38. FIELD OF VIEW	39. GROUND SWATH	
	DEG NA	
40. ANGULAR RESOLUTION (1/41. SPATIAL RESOLUTION		
0.1 DEG 70 KM ALONG ORBIT (MODE A); 15 KM ALONG ORBIT (MODE B)		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
		HIGH
46. SPECIAL REQUIREMENTS	47. COMPONENTS	
MASS SPECTROMETER, ASSOCIATED ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
10 LB	0.37 CU FT	51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. THERMAL
		58. SHIELDING
		59. DATA RECOVERY
		60. FREQUENCY OF OBSERVATION
		61. FREQUENCY OF OBSERVATION
		62. TELEMETRY REQUIREMENTS
		63. ADVANTAGES AND LIMITATIONS
		64. REFERENCES
		65. HISTORICAL REMARKS
		66. DIAGRAMS

5. CHANNELS-5 SAMPLES/SEC FOR ANALOG SPECTRUM; 1 CHANNEL-5 SAMPLES /SEC FOR SWEEP; 2 CHANNELS-1 SAMPLE/SEC FOR PEAK SELECTOR; 10 CHANNELS-1 SAMPLE/16 SEC FOR PARAMETRIC VOLTAGE MONITORS.

BASED ON SUCCESS OF SIMILAR OGO-4 EXPERIMENT IN JULY, 1967

1) TAYLOR, H.A., ET AL: PROPOSAL FOR A POSITIVE ION COMPOSITION EXPERIMENT FOR NIMBUS B, GSPC.\*\*\*2) TAYLOR, H.A., ET AL: POSITIVE ION COMPOSITION IN THE MAGNETOSPHERE OBTAINED FROM THE OGO-A ION COMPOSITION IN THE MAGNETOSPHERE OBTAINED FROM THE OGO-A

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
SELECTIVE CHOPPER RADHOMETER	SCR	E05							
(TITLE CONT.)	4. RESUME	5. VERSION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
HOUGHTON, DR. J. AND	CLARENDON LAB, OXFORD, ENG	0X5-9291							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
SMITH, DR. S./JOINT PI	READING UNIV, READING, ENG	R88-4372							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETED	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME		
SCHARDT, B.	NASA HDQTRS	OSSA/SRN	202-962-0891		ENGLAND		30 MONTHS		
ELLIOTT-AUTOMATION									
26. INSTRUMENT TYPE									
RADHOMETER, 13-CHANNEL INFRARED SELECTIVE CHOPPER									
28. APPLICATION									
NET									
30. PURPOSE									
PRIMARY - TO OBSERVE ATMOSPHERIC TEMPERATURE STRUCTURE UP TO 50 KM IN ALTITUDE *** SECONDARY-TO PROVIDE QUANTITATIVE INFORMATION ABOUT THE DENSITY AND DISTRIBUTION OF CIRRUS CLOUDS AND TROPOSPHERIC WATER VAPOR.									
31. PRINCIPLES OF OPERATION	<p>THE INSTRUMENT HAS 13 CHANNELS FROM 8 TO 200 MICRONS. 7 CHANNELS OBSERVE IN THE 15 MICRON CO2 BAND, 2 CHANNELS SOUND THE WATER-VAPOR DISTRIBUTION, AND 4 CHANNELS OBSERVE CIRRUS CLOUDS. THE MAIN CALIBRATION ERROR REFLECTS RADIATION FROM THE EARTH ONTO TWO VIBRATING MIRRORS WHICH CHOP THIS RADIATION RELATIVE TO SPACE AT 10 HZ. RADIATION FROM THE FIRST MIRROR IS REFLECTED VIA TWO WHITE CELL MIRRORS ONTO TWO DICHOIC BEAM SPLITTERS. THE RADIATION TRANSMITTED BY THESE DICHOIC MIRRORS IS DETECTED AS CHANNELS 9 AND 10, AT 45 AND 133 MICRON CENTER WAVELENGTHS FOR THE DETECTION OF HIGH CIRRUS CLOUDS. THE REFLECTED COMPONENTS FROM THE DICHOIC MIRRORS PASS THROUGH TWO FILTER WHEELS EACH HAVING FOUR FILTERS ONTO TWO THERMISTOR BOLOMETERS, AND ARE DETECTED AS CHANNELS 3 TO 8, 11 AND 12 COVERING 9 TO 18 MICRONS. POB TEMPERATURE SOUNDING AND WATER VAPOR MEASUREMENT. CHANNEL 13 USES A FAST DETECTOR WHICH IS SCANNED BY THE CHOPPER PROVIDING FAIRLY HIGH SPATIAL RESOLUTION. RADIATION FROM THE SECOND VIBRATING MIRROR IS PASSED ALTERNATELY THROUGH A CELL CONTAINING CO2 AND AN EMPTY CELL. THE TWO SIGNALS ARE COMPARED AND THE TEMPERATURE FROM 30-50 KM MAY BE INFERRED. IN-FLIGHT CALIBRATION IS NEEDED TO ESTABLISH BOTH OVERALL GAIN AND ZERO LEVEL.</p>								
32. PHENOMENA OBSERVED	RADIATION FROM EARTH, ATMOSPHERE, CLOUDS IN 8-200 MICRON REGION								
33. MEASUREMENT RANGE	0 TO 0.35 MILLIBARS OF PRESSURE; 200 TO 250 DEGREES KELVIN								
34. PRECISION AND ACCURACY	TEMPERATURE ACCURATE TO WITHIN 1 CENTIGRADE DEGREE								

35. SPECTRAL RANGE	8.0 TO 200.0 MICRON	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	DEG 48 KM DIAM CIRCLE FROM 1100 KM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	42. POINTING RATE	43. ALTITUDE
0.6 DEG 10 KM FROM 1100 KM ALTITUDE FOR CHANNEL 13			
44. SPECIAL REQUIREMENTS	45. MED	46. INCLINATION	
47. COMPONENTS	SINGLE VIEW TO EARTH WITH 23 DEGREE CLEAR CONE ANGLE OF VIEW.		
RADHOMETER WITH ASSOCIATED OPTICS AND ELECTRONICS PACKAGE			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
25 LB	0.31 CU FT	7 WATTS	6 WATTS
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. SHIELDING
NONE	NONE	NONE	SENSITIVE
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
AT TIMES SELECTED	DELAYED TELMETRY		
59. TELEMETRY REQUIREMENTS	7 ANALOGUE CHANNELS WITH HALF PERCENT ACCURACY SAMPLED 1 PER SECOND FOR RADHOMETERS; 43 ANALOGUE CHANNELS FOR MONITORING; 33 CHANNELS OF DIGITAL TELMETRY.		
60. ADVANTAGES AND LIMITATIONS	UPPER LEVELS OF ATMOSPHERE CAN BE INVESTIGATED, GOOD RADHOMETRIC ACCURACY, SAME CALIBRATION COMMON TO ALL CHANNELS; MOVING PARTS		
61. REFERENCES	<p>1) PROPOSAL FOR SELECTIVE CHOPPER RADHOMETER FOR WATER VAPOR, CLOUD, AND ATMOSPHERIC TEMPERATURE SOUNDING, MAR 68.***2) STATUS REPORT - APPLICATION OF SPACE TECHNOLOGY TO THE WORLD WEATHER WATCH, JUN 67.***3) PROPOSAL FOR A SELECTIVE CHOPPER RADHOMETER ON NIMBUS D, OXFORD AND READING UNIV, APR 66.***4) MEASUREMENTS WITH BALLOON-BORNE SELECTIVE RADHOMETER, CLARENDON LAB, JUN 66.</p>		
62. HISTORICAL REMARKS			
63. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
SURFACE-COMPOSITION MAPPING RADIOMETER		SCNR		E23					
(TITLE CONT.)		4. RESUME		5. VERSION					
		DATE		11/10/69		0005			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
HOVIS, DR. W.A.		GODDARD SPACE FLT CENTER		301-982-6465					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
CALLAHAN, W.R.		FAIRFIELD UNIVERSITY		203-255-1011					
12. CONTRACT NUMBER		13. START DATE		14. STATUS					
13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE					
16. MONITOR		17. AGENCY		18. PRELIM DSGN					
SCHARDT, B.		NASA HQ/OTRS		01769					
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
				06/72		33 MONTHS			
26. INSTRUMENT TYPE		27. SECOND		28. APPLICATION		29. SPACECRAFT		UNC	
RADIOMETER, TWO-CHANNEL SCANNING INFRARED						NIMBUS E			
29. PURPOSE		30. INSTRUMENT TYPE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED			
<p>PRIMARY-TO IDENTIFY VARIOUS IGNEOUS ROCK TYPES FROM AN ORBITING SPACECRAFT. TO PRODUCE A THERMAL MAP OF THE SURFACE GIVING SOIL AND SEA SURFACE TEMPERATURES AND ESPECIALLY STRONG SURFACE TEMPERATURE GRADIENTS.***SECONDARY-TO TEST THE APPLICABILITY OF THE RADIOMETER TO MEASURE THE RESTSTRAHLEN (RESIDUAL WAVES) OF ROCKS AND OTHER MATERIALS FROM SPACE.</p> <p>MEASUREMENT OF THE RESTSTRAHLEN OR RESIDUAL WAVES OF VARIOUS IGNEOUS ROCKS WILL PERMIT ROCK IDENTIFICATION, SINCE THE WAVELENGTH OF THESE WAVES VARIES WITH THE DEGREE OF THE ACIDITY OF THE ROCK. IGNEOUS ROCKS ARE DESCRIBED BY A TERMINOLOGY BASED ON THE SiO2 OR 'ACIDIC' OXIDE CONTENT. THE RESTSTRAHLEN LOWERS THE APPARENT TEMPERATURE, MEASURED RADIOMETRICALLY, BY 12 TO 15 DEGREES C AT CERTAIN WAVELENGTHS. THIS EFFECT CAN BE UTILIZED BY SCANNING SIMULTANEOUSLY IN TWO CHANNELS, 8.3 TO 9.3 AND 10.2 TO 11.2 MICRONS, BOTH AVOIDING THE OZONE BAND. IF ONE CHANNEL RECORDS A LOWER APPARENT RADIANT TEMPERATURE THAN THE OTHER THE DIFFERENCE IS MOST LIKELY DUE TO A DIFFERENCE IN EMISSIVITY. THE PROPOSED RADIOMETER IS AN OUTGROWTH OF THE HRIR AND MRIR FLOWN ON NIMBUS 1 AND 2. THE BASIC COMPONENTS ARE A SCAN MIRROR FOR SPATIAL SCANNING PERPENDICULAR TO SPACECRAFT MOTION, A TELESCOPE TO ENHANCE SPATIAL RESOLUTION, TWO DETECTORS WITH APPROPRIATE FILTERS DEFINING THE WAVELENGTHS INTERVALS DESIRED AND A COOLING DEVICE. THE ROTATING MIRROR IS SPUN AT A RATE SO THAT SUCCESSIVE SCANS ARE CONTIGUOUS. THOUGH THE MIRROR WILL SCAN FROM HORIZON TO HORIZON, DISTORTION AT HIGH ANGLES TO THE LOCAL VERTICAL WILL LIMIT THE USEFUL PORTION OF THE SCAN TO ABOUT 60 DEGREES.</p>									
INFRARED RESTSTRAHLEN (RESIDUAL WAVES) OF SURFACE MATERIALS									
33. MEASUREMENT RANGE									
DETECTIVITY OF ABOUT 10 TO THE TENTH AT 80 DEGREES KELVIN									
34. PRECISION AND ACCURACY									
NOISE EQUIVALENT DELTA T = 0.17 DEG K AT 280 DEG K AND 10 MICRONS									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
8.3 TO 11.2 MICRONS		33.3 PERCENT			
38. FIELD OF VIEW		39. GROUND SWATH			
60. RY 0.03 DEG		800 KM BY 0.6 KM AT 1000 KM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.03 DEG		0.6 BY 0.6 KM AT 1000 KM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
				MED	
46. SPECIAL REQUIREMENTS					
INSTRUMENT WILL REQUIRE A CLEAR DEEP SPACE VIEW					
47. COMPONENTS					
RADIOMETER, TELESCOPE, COOLER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
55 LB		1.0 CU FT		8 WATTS	
51. STANDBY POWER		52. PEAK POWER		53. ATTEN	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
NONE		NONE		SENSITIVE	
57. DATA RECOVERY		58. FREQUENCY OF OBSERVATION		59. MIN/ORBIT MAX	
SEE ITEM 62		10 MIN/ORBIT MAX			
60. TELEMETRY REQUIREMENTS					
RADIOMETER WILL REQUIRE 10000 SAMPLES PER SECOND PER CHANNEL FOR MAXIMUM OF 10 MINUTES PER ORBIT. LESS IF RESOLUTION IS DEGRADED. STORAGE VS REAL-TIME TELEMETRY HAS NOT BEEN DEDINED.					
61. ADVANTAGES AND LIMITATIONS					
DAY AND NIGHT SCANNING, RADIATIVE COOLING, HIGH RESOLUTION, BASED ON HRIR AND MRIR EXPERIENCE; MOVING PARTS.					
62. REFERENCES					
1) HOVIS, W.A. AND CALLAHAN, W.R.: PROPOSAL FOR A HIGH RESOLUTION SURFACE COMPOSITION MAPPING RADIOMETER FOR NIMBUS E.***2) LYON, R.J.: FIELD INFRARED ANALYSIS OF TERRAIN, 1ST ANNUAL REPT, NASA GRANT NGR-05-020-115.***3) HOVIS, W.A., APPLIED OPTICS, V. 5, 1965.***4) NORDBERG, W., SCIENCE, V. 150, NO. 3696, 1965.					
63. HISTORICAL REMARKS					
OUTGROWTH OF HRIR AND MRIR FLOWN ON NIMBUS 1 AND 2.					
64. DIAGRAMS					

TIROS 1

35. SPECTRAL RANGE		0.4 TO 0.65 MICRON		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
38. FIELD OF VIEW		10.0 BY 10.0 DEG 54 NM BY 54 NM FROM 450 NM ALTITUDE		39. GROUND SWATH			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION		42. POINTING ACCURACY		43. ALTITUDE	
44. POINTING RATE		45. INCLINATION		46. SPECIAL REQUIREMENTS		47. COMPONENTS	
48. WEIGHT		49. VOLUME		50. AVERAGE POWER		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE		55. INTERFERENCE	
56. INTERFERENCE		57. INTERFERENCE		58. SHIELDING		59. HATTS	
60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS	
64. REFERENCES		65. HISTORICAL REMARKS		66. DIAGRAMS			

TV CAMERA - TRANSMITTER TAPE RECORDER

NO IN-FLIGHT CALIBRATION DELAYED OR REALTIME DAYSIDE OF ORBIT

FULL REEL OF 32 PICTURES CAN BE READ OUT IN APPROX 100 SECS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.

SHOWN DETAILS OF SPECIFIC CLOUD TYPES.

1) SIGNIFICANT ACHIEVEMENTS IN SAT NET 1958-1964. NASA SP-96.\*\*\*  
 2) GOLDBERG, E. A. AND LANDON, V. D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V. 5, JUNE 1960.\*\*\*  
 3) MESNER, M. H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V. 5, MAY 1960.\*\*\*  
 4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.\*\*\*  
 5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.

INSTRUMENT RESUME				NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME	
VIDICON CAMERA SYSTEM		VCSN		11/10/69		0003	
5. VENDOR		6. ORGANIZATION		7. ORGANIZATION		8. TELEPHONE	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		12. STATUS	
13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
17. MONITOR		18. AGENCY		19. PGM OFFICE		20. TELEPHONE	
21. VENDOR		22. LOCATION		23. DATE		24. LEAD TIME	
25. INSTRUMENT TYPE		26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION	
29. PURPOSE		30. SPACECRAFT		31. INSTRUMENT TYPE		32. INSTRUMENT TYPE	
33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY		35. MEASUREMENT RANGE		36. PRECISION AND ACCURACY	

PRIMARY-TO ACQUIRE AND TRANSMIT (REALTIME OR DELAYED) PICTURES OF THE EARTH'S CLOUD COVER SHOWING SPECIFIC CLOUD TYPES IN GREATER DETAIL THAN WIDE AND MEDIUM ANGLE CAMERAS.

THIS NARROW ANGLE VIDICON CAMERA IS IDENTICAL TO THE ONE THAT WAS FLOWN SUBSEQUENTLY ON TIROS 2. IT CONSISTS OF A 1/2-INCH VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A NARROW ANGLE (12 DEGREES) CINEGOR F/1.5 LENS PRODUCING A RESOLUTION OF ABOUT 1000 FEET. THE PHOTOGRAPHS ARE WITHIN THE WIDE-ANGLE CAMERA VIEWS. THE CAMERA HAS A SHUTTER SPEED OF 1-5 MILLISECONDS AND A VIDEO BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SECONDS BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 10 SECONDS BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.

32. PHENOMENA OBSERVED

CLOUD COVER OVER THE EARTH'S SURFACE

33. MEASUREMENT RANGE

5 LEVELS OF GRAY

34. PRECISION AND ACCURACY

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
VIDICON CAMERA SYSTEM	VCSW	4. RESUME DATE							
(TITLE CONT.)									
5. WIDE-ANGLE LENS	6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE						
STROUD, W. G. (NGR)	GODDARD SPACE FLT CENTER	301-982-4400	11. TELEPHONE						
9. CO-INVESTIGATOR	10. ORGANIZATION								
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GABACZ, M.L.	NASA HQ/RTS	OSSA/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY	04/60	NA						
26. INSTRUMENT TYPE									
IMAGER, WIDE-ANGLE F/1.5 LOW-RESOLUTION 0.5-INCH VIDICON									
28. APPLICATION	29. SPACECRAFT								
NET	TIROS 1								
30. PURPOSE									
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS.***SECONDARY-TO TEST TV SENSOR IN SPACE.									
31. PRINCIPLES OF OPERATION THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1. ON TIROS 1-8, 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 0.5 IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELGET F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 NM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT PM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.									
32. PHENOMENA OBSERVED CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE 5 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.4 TO 0.65 MICRON NA		
38. FIELD OF VIEW	39. GROUND SWATH	
74.0 BY 74.0 DEG 650 NM BY 650 NM FROM 450 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.2 DEG 1.4 NM PER TV LINE FROM 450 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	MED CIRCULAR	MEDIUM POSIGRADE
47. COMPONENTS		
TV CAMERA, TRANSMITTER, TAPE RECORDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
		57. INTERFERENCE
		58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
NO IN-FLIGHT CALIBRATION DELAYED AND REALTIME DAYSIDE OF ORBIT		
62. TELEMETRY REQUIREMENTS		
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS		
63. ADVANTAGES AND LIMITATIONS		
BROAD SYNOPTIC VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED. OR NARROW ANGLE CAMERAS		
64. REFERENCES		
1) SIGNIFICANT ACHIEVEMENTS IN SAT NET 1958-1964. NASA SP-96.*** 2) GOLDBERG, E. A. AND LANDON, V. D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V. 5, JUNE 1960.***3) MESNER, M. H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V. 5, MAY 1960.*** 4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.		
65. HISTORICAL REMARKS		
IDENTICAL CAMERA FLOWN ON TIROS 1-10 AND SIMILAR ON ESSA 1		
66. DIAGRAMS		

TIROS 2



INSTRUMENT RESUME											
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS											
1. TITLE		2. ACRONYM		3. EXP NO							
LOW-RESOLUTION NONSCANNING RADIOMETER		LRNR									
(TITLE CONT.)		4. RESUME DATE		5. VERSION							
		11/10/69		0003							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE							
HANEL, DR. R.		GODDARD SPACE FLT CENTER		301-982-4528							
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE							
STAMPFL, DR. R. A.		GODDARD SPACE FLT CENTER		301-982-6163							
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		17. STATUS			
								POST FLIGHT			
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE					
GABRACZ, M.L.		NASA HQ/RTS		OSSA/SRO		202-963-4291					
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME					
BARNES ENGINEERING CO		STAMFORD, CONN.		11/60		NA					
26. INSTRUMENT TYPE		27. ACRONYM		28. APPLICATION		29. SPACECRAFT					
RADIOMETER, 2-CHANNEL NON-SCANNING LOW-RESOLUTION INFRARED				TIROS 2							
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE					
PRIMARY-TO MEASURE THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH, TO PERMIT THE DETERMINATION OF THE APPARENT BLACKBODY TEMPERATURES AND ALBEDO OF THE EARTH.		THIS LOW-RESOLUTION NON-SCANNING RADIOMETER WAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 2, 3, AND 4. IT CONSISTS OF 2 DETECTORS. ONE OF THESE IS A BLACK THERMISTOR BOLOMETER DETECTOR AND THE OTHER A WHITE ONE, EACH OF WHICH IS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE CONE. THE BLACK DETECTOR IS EQUALLY SENSITIVE TO REFLECTED SUNLIGHT AND TO LONG WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR IS COATED TO BE REFLECTIVE IN THE VISIBLE AND NEAR INFRARED, THUS, IT MEASURES ONLY LONG WAVELENGTH THERMAL RADIATION (5 TO 50 MICRONS). THESE DETECTORS PRESENT THE INSTRUMENTATION PACKAGE WITH RESISTANCES WHICH VARY WITH RADIATION. FROM THE DETECTED VALUES THE HEAT BALANCE OF AN AREA CAN BE COMPUTED. THE FIELD WHEN VIEWING DIRECTLY BELOW IS PARALLEL TO THE SPIN AXIS AND IS A CIRCLE OF 470 NM DIAMETER (50-DEGREE FIELD OF VIEW). THIS VIEW OBSERVES AN AREA WHICH IS WITHIN THE FIELD OF THE WIDE ANGLE TELEVISION CAMERA. THE OUTPUT OF EACH DETECTOR IS AMPLIFIED, AND THE RESULTING SIGNAL IS USED TO MODULATE SEPARATE AUDIO-FREQUENCY OSCILLATORS. THIS MODULATED OUTPUT IS PROCESSED THROUGH THE TIME-SHARING SWITCHING CIRCUIT WITH THE OUTPUT OF THE SCANNING RADIOMETER.		THERMAL AND REFLECTED SOLAR RADIATION FROM EARTH		-100 DEG C TO +60 DEG C		PRECISION AND ACCURACY		S/N BETTER THAN 30 DB	

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.2 TO 50.0 MICRONS		SEE ITEM 31			
38. FIELD OF VIEW		39. GROUND SWATH			
50.0 DEG 470 NM DIAM CIRCLE FROM 410 NM ALTITUDE		40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION	
50.0 DEG 470 NM DIAM CIRCLE FROM 410 NM ALTITUDE		42. POINTING ACCURACY		43. POINTING RATE	
		44. ALTITUDE		45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR MEDIUM		POSIGRADE	
47. COMPONENTS					
2 THERMISTORS, REFERENCE RESISTORS, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
2 LB				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
				57. INTERFERENCE	
				58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		SENSITIVE		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
BY REFERENCE RESISTORS DELAYED TELEMETRY					
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR), THE 7 CHANNELS HAVE A TOTAL WIDTH OF 310 HZ.					
63. ADVANTAGES AND LIMITATIONS					
STRONG THERMAL COUPLING BETWEEN DETECTOR AND SATELLITE. WHITE DETECTOR COATING AND CONE OPTICS INADEQUATE IN SPECTRAL RESPONSE					
64. REFERENCES					
1) IR AND REFLECTED SOLAR RADIATION MEASUREMENTS FROM TIROS 2 MET SAT. NASA TN D-1096, NOV. 1961. (**) BANDEEN, W.R.: EXPERIMENTAL APPROACHES TO REMOTE ATMOSPHERIC PROBING IN THE IR FROM SATS. NASA TN X-63188, MAY 1968. (**) BARTKO, F., ET AL.: TIROS LOW RESOLUTION RADIOMETER. NASA TN D-614, SEPT. 64. (**) DATA AVAILABLE FROM WORLD DATA CENTER, ASHEVILLE, N.C.					
65. HISTORICAL REMARKS					
IDENTICAL RADIOMETERS FLOWN ON TIROS 2, 3, AND 4					
66. DIAGRAMS					

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
<b>MEDIUM-RESOLUTION RADIOMETER</b>									
6. PRINCIPAL INVESTIGATOR					7. ORGANIZATION				
NOBBERS, DR. W.					GODDARD SPACE FLT CENTER 301-982-5003				
8. CO-INVESTIGATOR					10. ORGANIZATION				
13. CONTRACT NUMBER					14. FLASH INDEX NUMBER				
18. MONITOR					19. AGENCY				
GARBACZ, M.L.					NASA HQ/RTS				
22. VENDOR					23. LOCATION				
					STANFORD, CONN.				
24. INSTRUMENT TYPE					25. SPACECRAFT				
RADIOMETER, 5-CHAN THERMISTOR-BOLOMETER MED-RES SCANNING IR					11/60 NA				
28. APPLICATION					29. PURPOSE				
HET					TIROS 2				
PRIMARY TO MEASURE EMITTED THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN 5 SPECTRAL REGIONS. PARAMETERS TO BE STUDIED ARE: ATMOSPHERIC WATER VAPOR ABSORPTION BAND, DAY-NIGHT TIME CLOUD COVER, ALBEDO, AND THERMAL RADIATION. TO GENERATE RADIATION MAPS FOR RESEARCH IN ATMOSPHERIC PROPERTIES.									
TIROS 2, 3, 4, 7, AND Nimbus 2 CONTAINED 5 CHANNEL SCANNING RADIOMETERS USING FILTERS AND BOLOMETER DETECTORS. THE Nimbus 2 RADIOMETER, WHILE SIMILAR IN PURPOSE, WAS A NEW INSTRUMENT DESIGN. ON THE TIROS SERIES PRECISE BANDWIDTHS VARIED FOR EACH FLIGHT, FOR TIROS 2 THEY WERE 5.72-7.0; 7.2-22.2; 0.26-7.6; 7.2-32.6; AND 0.365-3.35 MICRONS. A REFERENCE LEVEL WAS OBTAINED BY HAVING THE DETECTORS ALTERNATELY LOOK INTO SPACE AT A 45 DEGREE ANGLE. EACH CHANNEL HAS THE SAME PRINCIPLE OF OPERATION: THE ALTERNATING VOLTAGE GENERATED AT THE THERMISTOR BOLOMETER IS PROPORTIONAL TO THE DIFFERENCE IN RADIATION ENERGY COMING FROM 2 OPPOSITE DIRECTIONS (THROUGH THE SATELLITE WALL AND BASE) AND IMPINGING UPON A CHOPPER DISK THAT HAS ALTERNATE BLACK AND MIRROR HALVES. ALL 5 DISKS ROTATE SIMULTANEOUSLY AT 46 RPS, AND HAVE IDENTICAL OUTPUT CIRCUITRY TO PREAMPLIFIERS AND TAPE RECORDERS. SATELLITE SPIN IS USED TO PROVIDE THE SCAN LINE, WHICH IS THEN ADVANCED BY ORBITAL MOTION OF THE SATELLITE. THE INSTRUMENT HAS A 5 DEG FOV FOR EACH CHANNEL. DATA ARE RECORDED ON THE SATELLITE'S ENDLESS LOOP OF MAGNETIC TAPE FOR A PERIOD OF 100 MIN.									
32. PHENOMENA OBSERVED									
RADIATION FROM EARTH AND ATMOSPHERE IN 5 SPECTRAL REGIONS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
A S/N RATIO OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF +/- 7 DEG K									

38. SPECTRAL RANGE		39. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.25 TO 32.6 MICRONS		SEE ITEM 31			
38. FIELD OF VIEW		39. GROUND SWATH			
5.0 DEG 35 NM DIAM CIRCLE FROM 410 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
5.0 DEG 35 NM AT CENTER FROM 410 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
		MED CIRCULAR		MEDIUM POSIGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
RADIOMETER (5 THERMISTOR BOLOMETER DETECTORS) - ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
6 L.B.				51. STANDBY POWER	
54. INTERFERENCE		55. MAGNETIC INTERFERENCE		56. THERMAL INTERFERENCE	
				57. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		SENSITIVE		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
SPACE LOOK FOR ZEROING DELAYED TELEMETRY					
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR); THE 7 CHANNELS HAVE A WIDTH OF 310 HZ.					
63. ADVANTAGES AND LIMITATIONS					
AN UNCERTAINTY EXISTS IN THE ABSOLUTE VALUES OF THE MEASUREMENTS BECAUSE OF NO INFLIGHT CALIBRATION.					
64. REFERENCES					
1) BANDEEN, W.R. ET AL.: INFRARED AND REFLECTED SOLAR RADIATION MEASUREMENTS FROM TIROS 2 MET SAT. NASA TN D-1096, NOV. 1967. ***					
2) DATA CATALOG OF SAT AND ROCKET EXPTS. NASA/GSPC-NATIONAL SPACE SCIENCE DATA CTR. REPT. NSSDC 68-01, JAN. 68. ***3)					
GOLDBERG, I.: NET IR INSTRUMENTS FOR SAT. NASA/GSPC, AUG. 68. ***					
DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CTR. NASA/GSFC.					
65. HISTORICAL REMARKS					
SIMILAR RADIOMETERS FLOWN ON TIROS 2, 3, 4, 7 AND Nimbus 2 (MIR)					
66. DIAGRAMS					



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	VIDICON CAMERA SYSTEM								
(TITLE CONT.)	WIDE-ANGLE LENS								
2. ACRONYM	3. EXP NO	VCSW							
4. REG. NO.	5. VERSION	11/10/69 0004							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	B. TELEPHONE							
8. CO-INVESTIGATOR	9. ORGANIZATION	11. TELEPHONE							
10. ORGANIZATION	GODDARD SPACE FLT CENTER 301-982-6163								
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS	POST FLIGHT			
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
GABRACZ, M.L.	NASA HDOTRS	OSSM/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY	11/60	NA						
26. INSTRUMENT TYPE	IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON								
27. SENSING	UNC.								
28. APPLICATION	29. SPACECRAFT								
30. PURPOSE	TIROS 2								
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS CAMERA SUB-SYSTEM HAS PLOWN IDENTICALLY ON TIROS 1 THRU 10. A SIMILAR CONFIGURATION HAS PLOWN ON ESSA 1. ON TIROS 1 THRU 8 &amp; 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELGBET F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 NM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-HAND-WIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SPIN AXIS OF THE SATELLITE, AND IS TURNED ON BY COMMAND. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SECONDS BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>									
32. PHENOMENA OBSERVED	CLOUD COVER AND THE EARTH'S SURFACE								
33. MEASUREMENT RANGE	7 TO 8 LEVELS OF GRAY								
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	0.5 TO 0.65 MICRON NA	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	74.0 BY 74.0 DEG 650 NM BY 650 NM FROM 410 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
	DEG 1.4 NM PER TV-LINE FROM 410 NM ALTITUDE	MED CIRCULAR	MEDIUM POSIGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
TV CAMERA, TRANSMITTER, TAPE RECORDER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANBY POWER
7 LBS		9 WATTS	9 WATTS
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. INTERFERENCE
SENSITIVE			
56. CALIBRATION	57. DATA RECOVERY	58. SHIELDING	59. FREQUENCY OF OBSERVATION
		MAGNETIC SHIELDING USED	
60. TELEMETRY REQUIREMENTS			
61. DELAYED AND REALTIME DAYSIDE OF ORBIT			
62. ADVANTAGES AND LIMITATIONS			
BROAD SYNOPSIS VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS			
63. REFERENCES			
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***			
2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***			
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.			
64. HISTORICAL REMARKS			
IDENTICAL CAMERA PLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.			
65. DIAGRAMS			

TIROS 3

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LOW-RESOLUTION NONSCANNING RADIOMETER (TITLE CONT.)			LRNR						
4. RESERVE	5. VARIATION								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
HANDEL, DR. R.	GODDARD SPACE FLT CENTER	301-982-4528							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
STAPPL, DR. R. A.	GODDARD SPACE FLT CENTER	301-982-6163							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. DATE	15. STATUS						
			POST FLIGHT						
16. MONITOR	17. AGENCY	18. PGM OFFICE	19. TELEPHONE						
GARACZ, M.L.	NASA HDOTRS	LOSSA/SRO	202-963-4291						
21. VENDOR	22. LOCATION	23. LEAD TIME	24. FLIGHT						
BARNES ENGINEERING CO	STAFFORD, CONN.	07/61	NA						
25. INSTRUMENT TYPE									
RADIOMETER, 2-CHANNEL NON-SCANNING LOW-RESOLUTION INFRARED									
26. APPLICATION	27. SPACECRAFT								
HET	TIROS 3								
28. PURPOSE									
PRIMARY-TO MEASURE THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH, TO PERMIT THE DETERMINATION OF THE APPARENT BLACKBODY TEMPERATURES AND ALBEDO OF THE EARTH.									
31. PRINCIPLES OF OPERATION									
<p>THIS LOW-RESOLUTION NON-SCANNING RADIOMETER WAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 2, 3, AND 4. IT CONSISTS OF 2 DETECTORS, ONE OF THESE IS A BLACK THERMISTOR BOLOMETER DETECTOR AND THE OTHER A WHITE ONE, EACH OF WHICH IS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE CONE. THE BLACK DETECTOR IS EQUALLY SENSITIVE TO REFLECTED SUNLIGHT AND TO LONG WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR IS COATED TO BE REFLECTIVE IN THE VISIBLE AND NEAR INFRARED, THUS, IT MEASURES ONLY LONG WAVELENGTH THERMAL RADIATION (5 TO 50 MICRONS). THESE DETECTORS PRESENT THE INSTRUMENTATION PACKAGE WITH RESISTANCES WHICH VARY WITH RADIATION. FROM THE DETECTED VALUES THE HEAT BALANCE OF AN AREA CAN BE COMPUTED. THE FIELD WHEN VIEWING DIRECTLY BELOW IS PARALLEL TO THE SPIN AXIS AND IS A CIRCLE OF 470 MM DIAMETER (50-DEGREE FIELD OF VIEW). THIS VIEW OBSERVES AN AREA WHICH IS WITHIN THE FIELD OF THE WIDE ANGLE TELEVISION CAMERA. THE OUTPUT OF EACH DETECTOR IS AMPLIFIED, AND THE RESULTING SIGNAL IS USED TO MODULATE SEPARATE AUDIO-FREQUENCY OSCILLATORS. THIS MODULATED OUTPUT IS PROCESSED THROUGH THE TIME-SHARING SWITCHING CIRCUIT WITH THE OUTPUT OF THE SCANNING RADIOMETER.</p>									
32. PHENOMENA OBSERVED									
THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH									
33. MEASUREMENT RANGE									
-100 DEG C TO +60 DEG C									
34. PRECISION AND ACCURACY									
S/N BETTER THAN 30 DB									

35. SPECTRAL RANGE	0.2 TO 50.0 MICRONS/SEE ITEM 31	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	50.0 DEG 470 MM DIAM CIRCLE FROM 475 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	42. ALTITUDE	43. INCLINATION
50.0 DEG 470 MM FROM 475 NM ALTITUDE		MED CIRCULAR	MEDIUM POSIGRADE
44. POINTING ACCURACY	45. POINTING RATE	46. SPECIAL REQUIREMENTS	
47. COMPONENTS			
2 THERMISTORS, REFERENCE RESISTORS, ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
2 LB		5 WATTS	30 WATTS
52. INTERFERENCE	53. NUCLEAR	54. SHIELDING	
55. CALIBRATION	56. DATA RECOVERY	57. FREQUENCY OF OBSERVATION	
BY REFERENCE RESISTORS	DELAYED TELEMETRY	CONTINUOUS	
58. TELEMETRY REQUIREMENTS			
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR), THE 7 CHANNELS HAVE A TOTAL WIDTH OF 310 HZ.			
63. ADVANTAGES AND LIMITATIONS			
STRONG THERMAL COUPLING BETWEEN DETECTOR AND SATELLITE. WHITE DETECTOR COATING AND CONE OPTICS INADEQUATE IN SPECTRAL RESPONSE			
64. REFERENCES			
<p>1) IR AND REFLECTED SOLAR RADIATION MEASUREMENTS FROM TIROS 2 MET SAT. NASA TN D-1096, NOV. 1961.***2) BANDEEN, W.R.: EXPERIMENTAL APPROACHES TO REMOTE ATMOSPHERIC PROBING IN THE IR FROM SATS. NASA TM X-63188, MAY 1968.***3) BARTKO, P., ET AL.: TIROS LOW RESOLUTION RADIOMETER. NASA TN D-614, SEPT. 64.***4) DATA AVAILABLE FROM WORLD DATA CENTER, ASHEVILLE, N.C.</p>			
65. HISTORICAL REMARKS			
IDENTICAL INSTRUMENT FLOWN ON TIROS 2, 3, AND 4.			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER	LROR								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0004							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SUOMI, DR. V.E.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
PARENT, DR. R. J.	UNIVERSITY OF WISCONSIN	608-262-5938							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARBACZ, M.L.	NASA HDOTRS	OSSA/SRO	201-963-4291						
22. VENDOR	23. LOCATION	24. LEAD TIME							
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	07/61 NA							
25. INSTRUMENT TYPE									
RADIOMETER, IR OMNIDIRECTIONAL NON-SCANNING LOW-RESOLUTION									
26. APPLICATION	27. SPACECRAFT								
NET	TIROS 3								
28. PURPOSE									
PRIMARY- TO MEASURE THE GROSS HEAT BUDGET OF THE EARTH.*** SECONDARY- TO DETERMINE HOW MUCH SOLAR ENERGY IS ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE AT THE UPPER BOUNDARY; THUS TO STUDY THE PRIME DRIVING FORCE OF THE CIRCULATION OF THE ATMOSPHERE.									
29. PRINCIPLES OF OPERATION	THIS EXPERIMENT WAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 3, 4, AND 7, AND WAS ALSO SIMILAR TO ONE ON EXPLORER 7. TWO WIDE ANGLE (180 DEG FOV) LOW-RESOLUTION IR DETECTION DEVICES, EACH COMPOSED OF A BLACK-AND-WHITE BOLOMETER AND A REFLECTING MIRROR, ARE MOUNTED 180-DEGREES APART ON TELESCOPING SUPPORTS WHICH PROJECT FROM THE SIDE OF THE SPACECRAFT. THE MIRRORS SHIELD EACH SENSOR FROM DIRECT RADIATION EMITTED BY THE SATELLITE'S BODY. BOTH BOLOMETERS HAVE A HIGH ABSORPTIVITY TO THE IR RADIATION FROM THE EARTH. THE BLACK BOLOMETER ALSO HAS A HIGH ABSORPTIVITY FOR SOLAR RADIATION. THUS REFLECTED AND EMITTED RADIATION CAN BE SEPARATED. THERMISTORS, FASTENED INSIDE OF THE HEMISPHERIC SHELLS, MEASURE SENSOR TEMPERATURES. MATCHED PAIRS OF THERMISTORS ARE CONNECTED IN SERIES WITH SIMILAR SENSORS ON OPPOSITE SIDES OF THE SPACECRAFT; THEREFORE, THE MEASURED SENSOR TEMPERATURE RECEIVED FROM THE SATELLITE IS AN AVERAGE OF TWO TEMPERATURES FROM MATCHED THERMISTORS AND SIMULATES THE RESPONSE OF AN ISOLATED SPHERE IN SPACE. THE INFORMATION TELEMETERED TO EARTH INCLUDES TEMPERATURES OF THE MIRRORS AND SENSORS AND A FIXED RESISTANCE VALUE WHICH ALLOWS ONE TO COMPENSATE FOR DRIFT OF THE ELECTRONICS IN THE SATELLITE.								
32. PHENOMENA OBSERVED	RADIANT ENERGY REFLECTED AND EMITTED BY THE EARTH.								
33. MEASUREMENT RANGE	128 DEG K TO 488 DEG K								
34. PRECISION AND ACCURACY	0.1 KELVIN DEGREE								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 60.0 MICRON NA		5. SECONDS
38. FIELD OF VIEW	39. GROUND SWATH	
180.0	DEG 500 NM RADIUS CIRCLE FROM 475 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	45. INCLINATION
46. SPECIAL REQUIREMENTS	47. CIRCULAR	MEDIUM POSIGRADE
47. COMPONENTS		
2. DETECTION DEVICES, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
3 LB		51. STANDBY POWER
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE
55. SENSITIVE MIRRORS	56. SHIELD SENSORS	
57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
59. DELAYED TELEMETRY	60. CONTINUOUS	
61. TELEMETRY REQUIREMENTS		
DATA FROM THIS AND OTHER IR EXPTS ON-BOARD ARE RECORDED CONTINUOUSLY FOR ONE ORBIT ON MAGNETIC TAPE FOR PLAYBACK ON COMMAND FROM ONE OF THE GROUND STATIONS.		
62. ADVANTAGES AND LIMITATIONS		
63. REFERENCES		
1) HOUSE, F.B., RADIATION BALANCE OF THE EARTH FROM A SATELLITE, PHD THESIS, U. OF WISC. 1965.***2) VONDERHAAR, T.H., VARIATIONS OF THE EARTH'S RADIATION BUDGET, PHD THESIS, U. OF WISC. 1968.***3) MISSION PLAN TIROS 7, GSFC RPT NO. X-650-63-99, MAY 1963.***4) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER, NASA/GSFC.		
64. HISTORICAL REMARKS		
IDENTICAL INSTRUMENT FLOWN ON TIROS 3, 4, AND 7. SIMILAR ON EXP 7.		
65. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
MEDIUM-RESOLUTION RADIONETER			MRR						
(TITLE CONT.)			4. RESUME DATE	5. V. NUMBER					
			11/10/69	0004					
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
NORDBERG, DR. W.	GODDARD SPACE FLT CENTER	301-982-5003							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARBACZ, M.L.	NASA HDQTRS	OSMA/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
BARNES ENGINEERING CO	STANFORD, CONN.	11/60	NA						
26. INSTRUMENT TYPE									
RADIOMETER, 5-CHANNEL THERMISTOR-BOLOMETER MED-RES SCANNING	UNC								
28. APPLICATION									
MET									
30. PURPOSE	TIROS 3								
<p>PRIMARY-TO MEASURE EMITTED THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN 5 SPECTRAL REGIONS. PARAMETERS TO BE STUDIED ARE: ATMOSPHERIC WATER VAPOR ABSORPTION BAND, DAY-NIGHT TIME CLOUD COVER, ALBEDO, AND THERMAL RADIATION. TO GENERATE RADIATION MAPS FOR RESEARCH IN ATMOSPHERIC PROPERTIES.</p> <p>TIROS 2,3,4,7, AND NIMBUS 2 CONTAINED 5-CHANNEL SCANNING RADIOMETERS USING FILTERS AND BOLOMETER DETECTORS. THE NIMBUS 2 RADIOMETER, WHILE SIMILAR IN PURPOSE, WAS A NEW INSTRUMENT DESIGN. ON THE TIROS SERIES PRECISE BANDWIDTHS VARIED FOR EACH FLIGHT, FOR TIROS 3 THEY WERE: 5.7-7.0; 7.07-25.0; 0.25-6.82; 7.4-32.6; AND 0.475-2.900 MICRONS. A REFERENCE LEVEL WAS OBTAINED BY HAVING THE DETECTORS ALTERNATELY LOOK INTO SPACE AT A 45 DEGREE ANGLE. EACH CHANNEL HAS THE SAME PRINCIPLE OF OPERATION: THE ALTERNATING VOLTAGE GENERATED AT THE THERMISTOR BOLOMETER IS PROPORTIONAL TO THE DIFFERENCE IN RADIATION ENERGY COMING FROM 2 OPPOSITE DIRECTIONS (THROUGH THE SATELLITE WALL AND BASE) AND IMPINGENT UPON A CHOPPER DISK THAT HAS ALTERNATE BLACK AND MIRROR HALVES. ALL 5 DISKS ROTATE SIMULTANEOUSLY AT 46 RPS, AND HAVE IDENTICAL OUTPUT CIRCUITRY TO PREAMPLIFIERS AND TAP RECORDERS. SATELLITE SPIN IS USED TO PROVIDE THE SCAN LINE, WHICH IS THEN ADVANCED BY ORBITAL MOTION OF THE SATELLITE. THE INSTRUMENT HAS A 5 DEG FOV FOR EACH CHANNEL. DATA ARE RECORDED ON THE SATELLITE'S ENDLESS LOOP OF MAGNETIC TAPE FOR A PERIOD OF 100 MIN.</p>									
32. PHENOMENA OBSERVED									
RADIATION FROM EARTH AND ATMOSPHERE IN 5 SPECTRAL REGIONS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
A S/N RATIO OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF +-7 DEG K									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.2 TO 32.6 MICRONS SEE ITEM 31		
38. FIELD OF VIEW	39. GROUND SWATH	
5.0 DEG 40 NM DIAM CIRCLE FROM 475 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
5.0 DEG 40 NM AT CENTER FROM 475 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		45. INCLINATION
46. SPECIAL REQUIREMENTS	47. COMPONENTS	
RADIOMETER (5 THERMISTOR BOLOMETER DETECTORS) - ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
6 LB		3 WATTS
51. STANDBY POWER	52. PEAK POWER	53. MTBF
54. INTERFERENCE	55. MAGNETIC INTERFERENCE	56. NUCLEAR INTERFERENCE
		57. THERMAL INTERFERENCE
58. SHIELDING	59. SENSITIVE	
60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
SPACE LOOK FOR ZEROING	DELAYED TELEMETRY	CONTINUOUS
62. TELEMETRY REQUIREMENTS		
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR); THE 7 CHANNELS HAVE A WIDTH OF 310 HZ.		
82. ADVANTAGES AND LIMITATIONS		
AN UNCERTAINTY EXISTS IN THE ABSOLUTE VALUES OF THE MEASUREMENTS BECAUSE OF NO INFLIGHT CALIBRATION.		
84. REFERENCES		
1) TIROS 4 RADIATION DATA CATALOG AND USER'S MANUAL GSFC, DEC 63. **2) DATA CATALOG OF SATELLITE AND ROCKET EXPTS. NSSDC 68-01, JAN 68. NASA/GSFC NATIONAL SPACE SCIENCE DATA CTR. **3) GOLDBERG, I.: METEOROLOGICAL INFRARED INSTRUMENTS FOR SATELLITES. NASA/GSFC, AUG. 1968. **4) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER. NASA/GSFC.		
65. HISTORICAL REMARKS		
SIMILAR RADIOMETERS FLOWN ON TIROS 2,3,4,7 AND NIMBUS 2 (MRR)		
66. DIAGRAMS		



INSTRUMENT RESUME														
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS														
1. TITLE														
VIDICON CAMERA SYSTEM														
2. ACRONYM 3. EXP NO														
VCSW														
4. RESUME DATE														
11/10/69 0004														
5. VERSION														
WIDE-ANGLE LENS														
6. PRINCIPAL INVESTIGATOR														
RADOS, R. M. (MGR.)														
7. ORGANIZATION														
GODDARD SPACE FLT CENTER														
8. CO-INVESTIGATOR														
301-982-5347														
9. ORGANIZATION														
11. TELEPHONE														
12. CONTRACT TYPE														
13. CONTRACT NUMBER														
14. FLASH INDEX NUMBER														
15. DATE														
16. COMPLETION DATE														
17. STATUS														
18. MONITOR														
19. AGENCY														
NASA HDQRS														
20. ROOM OFFICE														
202-963-4291														
21. TELEPHONE														
22. VENDOR														
GARBACZ, M.J.														
23. LOCATION														
PRINCETON, NEW JERSEY														
24. LEAD TIME														
07/61 NA														
25. LEAD TIME														
26. INSTRUMENT TYPE														
RCA ASTRO-ELECTRONICS														
27. APPLICATION														
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW RESOLUTION VIDICON														
28. APPLICATION														
29. SPACECRAFT														
TIROS 3														
30. PURPOSE														
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS.***SECONDARY-TO TEST TV SENSOR IN SPACE.														
31. PRINCIPLES OF OPERATION														
THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1, HOWEVER ON THIS FLIGHT (TIROS 3) 2 WIDE ANGLE CAMERAS WERE USED. IT CONSISTS OF A 1/2 IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELGET F/1.5 LENS PRODUCING A RESOLUTION OF 1.5 TO 2.0 MM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT NOMINAL PREQUENCY OF 235 MHZ.														
32. PHENOMENA OBSERVED														
CLOUD COVER AND THE EARTH'S SURFACE														
33. MEASUREMENT RANGE														
7 TO 8 LEVELS OF GRAY														
34. PRECISION AND ACCURACY														

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.5 TO 0.65 MICRONS NA					
38. FIELD OF VIEW		39. GROUND SWATH			
74.0 BY 74.0 DEG 750 NM 750 NM FROM 475 NM ALTITUDE					
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION					
0.2 DEG 1.5 NM PER TV-LINE FROM 475 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
				46. SPECIAL REQUIREMENTS	
				RED CIRCULAR MEDIUM POSIGRADE	
47. COMPONENTS					
TV CAMERA, TRANSMITTER, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
7 LB				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. NUCLEAR RADIATION	
SENSITIVE				57. SHIELDING	
				58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
				MAGNETIC SHIELDING USED	
NO IN-FLIGHT CALIBRATION DELAYED AND REALTIME DAYSIDE OF ORBIT					
62. TELEMETRY REQUIREMENTS					
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.					
63. ADVANTAGES AND LIMITATIONS					
BROAD SYNOPTIC VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS					
64. REFERENCES					
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***					
2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***					
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966. ***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.					
65. HISTORICAL REMARKS					
IDENTICAL CAMERA FLOWN ON TIROS 1-10; SIMILAR CAMERA ON ESSA 1					
66. DIAGRAM					

TIROS 4

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
LOW-RESOLUTION NONSCANNING RADIOMETER		LRNR							
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0003					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
HANEL, DR. R.		GODDARD SPACE FLT CENTER		301-982-4528					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
STAPPL, DR. R.A.		GODDARD SPACE FLT CENTER		301-982-6163					
12. CONTRACT		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
								17. STATUS	
								POST FLIGHT	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE			
GARBACZ, M.L.		NASA HDOTRS		OSSA/SRO		202-962-4291			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
BARNES ENGINEERING CO		STAMFORD, CONN.		02/62		NA			
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
RADIOMETER, 2-CHANNEL NON-SCANNING LOW-RESOLUTION INFRARED								TIROS 4	
PRIMARY-TO MEASURE THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH, TO PERMIT THE DETERMINATION OF THE APPARENT BLACKBODY TEMPERATURES AND ALBEDO OF THE EARTH.									
31. PRINCIPLES OF OPERATION									
THIS LOW-RESOLUTION NON-SCANNING RADIOMETER WAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 2, 3, AND 4. IT CONSISTS OF 2 DETECTORS. ONE OF THESE IS A BLACK THERMISTOR BOLOMETER DETECTOR AND THE OTHER A WHITE ONE, EACH OF WHICH IS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE CONE. THE BLACK DETECTOR IS EQUALLY SENSITIVE TO REFLECTED SUNLIGHT AND TO LONG WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR IS COATED TO BE REFLECTIVE IN THE VISIBLE AND NEAR INFRARED, THUS, IT MEASURES ONLY LONG WAVELENGTH THERMAL RADIATION (5 TO 50 MICRONS). THESE DETECTORS PRESENT THE INSTRUMENTATION PACKAGE WITH RESISTANCES WHICH VARY WITH RADIATION. FROM THE DETECTED VALUES THE HEAT BALANCE OF AN AREA CAN BE COMPUTED. THE FIELD WHEN VIEWING DIRECTLY BELOW IS PARALLEL TO THE SPIN AXIS AND IS A CIRCLE OF 470 MM DIAMETER (50-DEGREE FIELD OF VIEW). THIS VIEW OBSERVES AN AREA WHICH IS WITHIN THE FIELD OF THE WIDE ANGLE TELEVISION CAMERA. THE OUTPUT OF EACH DETECTOR IS AMPLIFIED, AND THE RESULTING SIGNAL IS USED TO MODULATE SEPARATE AUDIO-FREQUENCY OSCILLATORS. THIS MODULATED OUTPUT IS PROCESSED THROUGH THE TIME-SHARING SWITCHING CIRCUIT WITH THE OUTPUT OF THE SCANNING RADIOMETER.									
32. PHENOMENA OBSERVED									
THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH									
33. MEASUREMENT RANGE									
-100 DEG C TO +60 DEG C									
34. PRECISION AND ACCURACY									
S/N BETTER THAN 30 DB									

38. SPECTRAL RANGE		39. SPECTRAL RESOLUTION		40. TIME CONSTANT	
0.2 TO 50.0		MICRONS		SEE ITEM 31	
38. FIELD OF VIEW		39. GROUND SWATH			
50.0		DEG 480 NM DIAM CIRCLE FROM 450 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
50.0		DEG 480 NM AT CENTER FROM 450 NM ALT			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
		MED CIRCULAR		MEDIUM	
46. SPECIAL REQUIREMENTS				POSIGRADE	
47. COMPONENTS					
2 THERMISTORS, REFERENCE RESISTORS, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
2 LB		5 WATTS		51. STANDARD POWER	
				52. PEAR POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
		SENSITIVE		30 WATTS	
56. CALIBRATION		57. DATA RECOVERY		58. FREQUENCY OF OBSERVATION	
				CONTINUOUS	
59. BY REFERENCE RESISTORS		60. DELAYED TELEMETRY			
61. FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR), THE 7 CHANNELS HAVE A TOTAL WIDTH OF 310 HZ.					
63. ADVANTAGES AND LIMITATIONS					
STRONG THERMAL COUPLING BETWEEN DETECTOR AND SATELLITE. WHITE DETECTOR COATING AND CONE OPTICS INADEQUATE IN SPECTRAL RESPONSE					
64. REFERENCES					
1) IR AND REFLECTED SOLAR RADIATION MEASUREMENTS FROM TIROS 2 MET SAT. NASA TN D-1096, NOV. 1961.***2) BANDEEN, W.R.: EXPERIMENTAL APPROACHES TO REMOTE ATMOSPHERIC PROBING IN THE IR FROM SATS. NASA TM X-63188, MAY 1968.***3) BARTKO, F., ET.AL.: TIROS LOW RESOLUTION RADIOMETER. NASA TN D-614, SEPT. 64.***4) DATA AVAILABLE FROM WORLD DATA CENTER, ASHEVILLE, N.C.					
65. HISTORICAL REMARKS					
IDENTICAL INSTRUMENT FLOWN ON TIROS 2, 3, AND 4					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER	LROR								
(TITLE CONT.)	4. RESUME DATE		5. VERSION						
	11/10/69		0004						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SDOMI, DR. V. E.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION								
PARENT, DR. R. J.	UNIVERSITY OF WISCONSIN	608-262-5938							
12. CONTRACT	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
GARBACZ, M.L.	NASA HDQTRS	OSSA/SRO	202-962-4291						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	02/62	NA						
26. INSTRUMENT TYPE									
RADIOMETER, IR OMNIDIRECTIONAL NON-SCANNING LOW-RESOLUTION									
28. APPLICATION	29. SPACECRAFT								
NET	TIROS 4								
30. PURPOSE									
PRIMARY- TO MEASURE THE GROSS HEAT BUDGET OF THE EARTH.*** SECONDARY- TO DETERMINE HOW MUCH SOLAR ENERGY IS ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE AT THE UPPER BOUNDARY; THUS TO STUDY THE PRIME DRIVING FORCE OF THE CIRCULATION OF THE ATMOSPHERE.									
31. PRINCIPLES OF OPERATION	THIS EXPERIMENT WAS PLANNED IN AN IDENTICAL CONFIGURATION ON TIROS 3, 4, AND 7, AND WAS ALSO SIMILAR TO ONE ON EXPLORER 7. TWO WIDE ANGLE (180 DEG FOV) LOW-RESOLUTION IR DETECTION DEVICES, EACH COMPOSED OF A BLACK-AND-WHITE BOLOMETER AND A REFLECTING MIRROR, ARE MOUNTED 180-DEGREES APART ON TELESCOPING SUPPORTS WHICH PROJECT FROM THE SIDE OF THE SPACECRAFT. THE MIRRORS SHIELD EACH SENSOR FROM DIRECT RADIATION EMITTED BY THE SATELLITE'S BODY. BOTH BOLOMETERS HAVE A HIGH ABSORPTIVITY TO THE IR RADIATION FROM THE EARTH. THE BLACK BOLOMETER ALSO HAS A HIGH ABSORPTIVITY FOR SOLAR RADIATION. THUS REFLECTED AND EMITTED RADIATION IS MEASURED. THE SENSOR TEMPERATURES ARE MEASURED BY THERMISTORS FASTENED TO THE INSIDE OF THE HEMISPHERIC SHELLS. MATCHED PAIRS OF THERMISTORS ARE CONNECTED IN SERIES WITH SIMILAR SENSORS ON OPPOSITE SIDES OF THE SPACECRAFT. THEREFORE, THE MEASURED SENSOR TEMPERATURE RECEIVED FROM THE SATELLITE IS AN AVERAGE OF TWO TEMPERATURES FROM MATCHED THERMISTORS AND SIMULATES THE RESPONSE OF AN ISOLATED SPHERE IN SPACE. THE INFORMATION TELEMETRED TO EARTH INCLUDES TEMPERATURES OF THE MIRRORS AND SENSORS AND A FIXED RESISTANCE VALUE WHICH ALLOWS ONE TO COMPENSATE FOR DRIFT OF THE ELECTRONICS IN THE SATELLITE.								
32. PHENOMENA OBSERVED	RADIANT ENERGY REFLECTED AND EMITTED BY THE EARTH.								
33. MEASUREMENT RANGE	128 DEG K TO 488 DEG K								
34. PRECISION AND ACCURACY	0.1 KELVIN DEGREE								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 60.0 MICRON NA		5. SECONDS
38. FIELD OF VIEW	39. GROUND SWATH	
180.0 DEG 470 NM RADIUS CIRCLE FROM 450 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	MED CIRCULAR
45. SPECIAL REQUIREMENTS	46. INCLINATION	47. POSTGRADE
48. COMPONENTS		
2 DETECTION DEVICES, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
3 LB		1 WATT
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
57. TELEMETRY REQUIREMENTS		
DATA FROM THIS AND OTHER IR EXPTS ON-BOARD ARE RECORDED CONTINUOUSLY FOR ONE ORBIT ON MAGNETIC TAPE FOR PLAYBACK ON COMMAND FROM ONE OF THE GROUND STATIONS.		
58. ADVANTAGES AND LIMITATIONS		
59. REFERENCES		
1) HOUSE, F.B., RADIATION BALANCE OF THE EARTH FROM A SATELLITE, PHD THESIS, U. OF WISC. 1965.***2) VONDERHAAR, T.H., VARIATIONS OF THE EARTH'S RADIATION BUDGET, PHD THESIS, U. OF WISC. 1968.***3) MISSION PLAN TIROS 7, GSFC RPT NO. X-650-63-99, MAY 1963.***4) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER, NASA/GSFC.		
60. HISTORICAL REMARKS		
FIRST MEASUREMENTS FROM S/C OF EARTH'S TOTAL RADIATION BUDGET.		
61. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME DATE		5. VENDOR	
MEDIUM-RESOLUTION RADIOMETER (TITLE CONT.)		MRR				11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
NORDBERG, DR. W.		GODDARD SPACE FLT CENTER		301-982-5003					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. FLIGHT DATE	
GABBACZ, M.L.		NASA HDOTRS		OSSA/SRO		202-962-4291			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		26. INSTRUMENT TYPE	
BARNES ENGINEERING CO		STAMFORD, CONN.		11/60		NA			
28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED	
RADIOMETER, 5-CHANNEL THERMISTOR-BOLOMETER		MED-RES SCANNING		UNC		MET		RADIATION FROM EARTH AND ATMOSPHERE IN 5 SPECTRAL REGIONS	
34. PRECISION AND ACCURACY		35. MEASUREMENT RANGE		36. INSTRUMENT RESOLUTION		37. TIME CONSTANT		38. FIELD OF VIEW	
A S/N RATIO OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF ±7 DEG K									

39. SPECTRAL RANGE		40. SPECTRAL RESOLUTION		41. TIME CONSTANT	
0.25 TO 12.0 MICRONS		SEE ITEM 31			
38. FIELD OF VIEW		39. GROUND SWATH			
5.0 DEG 35 NM DIAM CIRCLE FROM 450 NM ALTITUDE					
40. ANGULAR RESOLUTION <sup>1</sup>		41. SPATIAL RESOLUTION			
5.0 DEG 35 NM AT NADIR FROM 450 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		MEDIUM POSIGRADE	
47. COMPONENTS		48. WEIGHT		49. VOLUME	
RADIOMETER (5 THERMISTOR BOLOMETER DETECTORS) - ELECTRONICS		6 LB		3 WATTS	
50. AVERAGE POWER		51. STANDBY POWER		52. PEAK POWER	
				53. MTSF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
				57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
SPACE LOOK FOR ZEROING		DELAYED TELEMETRY		CONTINUOUS	
61. TELEMETRY REQUIREMENTS		62. TELEMETRY REQUIREMENTS			
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR), THE 7 CHANNELS HAVE A WIDTH OF 310 HZ.					
63. ADVANTAGES AND LIMITATIONS		64. REFERENCES		65. HISTORICAL REMARKS	
AN UNCERTAINTY EXISTS IN THE ABSOLUTE VALUES OF THE MEASUREMENTS BECAUSE OF NO INELIGHT CALIBRATION.		1) TIROS 4 RADIATION DATA CATALOG AND USER'S MANUAL. GSFC, DEC. 63.***2) DATA CATALOG OF SATELLITE AND ROCKET EXPTS. NASA/GSPC-NATIONAL SPACE SCIENCE DATA CENTER, REPORT NO. NSSDC 68-01, JAN. 1968.***3) GOLDBERG, I.: MET INSTRUMENTS FOR SATELLITES. NASA/GSFC, AUG. 68.***4) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER. NASA/GSFC.		SIMILAR RADIOMETERS FLOWN ON TIROS 2,3,4,7 AND NIMBUS 2 (MRR)	
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
VIDICON CAMERA SYSTEM		VCSM							
(TITLE CONT.)		4. DATE		5. VERSION					
		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
RADOS, R. M. (MGR.)		GODDARD SPACE FLT CENTER		301-982-5347					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE		17. STATUS	
								POST FLIGHT	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE			
GARBACZ, M.L.		NASA HDOTRS		OSSA/SRO		202-962-4291			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		02/62		NA			
26. INSTRUMENT TYPE		27. SERIAL		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
IMAGER, 0.5-INCH MEDIUM ANGLE F/1.8 VIDICON								TIROS 4	
31. PRINCIPLES OF OPERATION		<p>THIS MEDIUM ANGLE VIDICON CAMERA SYSTEM WAS ALSO FLOWN, IN IDENTICAL CONFIGURATION, ON TIROS 5 AND 6. IT CONSISTS OF A 1/2-INCH VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A MEDIUM ANGLE (76 DEGREES) TEGEA F/1.8 LENS PRODUCING A RESOLUTION OF ABOUT 1.0 MILE. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISECONDS AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 12 SECS. A MINIMUM INTERVAL, BETWEEN PICTURES, OF 10 SECONDS IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SECONDS BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>							
32. PHENOMENA OBSERVED		CLOUD COVER OVER THE EARTH'S SURFACE							
33. MEASUREMENT RANGE		7 TO 8 LEVELS OF GRAY							
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	0.5 TO 0.65 MICRONS NA	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	56.0 BY 56.0 DEG 500 NM BY 500 NM FROM 450 NM ALTITUDE	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
0.12 DEG 1.0 NM PER TV-LINE FROM 450 NM ALTITUDE			
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	MEDIUM POSIGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
TV CAMERA, TRANSMITTER, TAPE RECORDER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
7 LB		9 WATTS	NONE
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. INTERFERENCE
58. SHIELDING	MAGNETIC SHIELDING USED		
SENSITIVE			
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	62. TELEMETRY REQUIREMENTS
NO IN-FLIGHT CALIBRATION DELAYED OR REALTIME			DAYSIDE OF ORBIT
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.			
63. ADVANTAGES AND LIMITATIONS			
BROAD SYNOPTIC VIEWING OF CLOUD-COVER PATTERNS. VALUABLE FOR ICE STUDY AND ICE RECONNAISSANCE.			
64. REFERENCES			
1) SIGNIFICANT ACHIEVEMENTS IN SATELLITE METEOROLOGY, 1958-1964, NASA SP-96.***2) INSTRUMENTS AND SPACECRAFT, OCT 57-MAR 65. NASA SP-3028.***3) NASA NEWS RELEASES FOR TIROS 4, 5, 6. RELEASE NO'S 62-24; 62-136; 62-194.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CENTER (NWSA) ASHEVILLE, N.C.			
65. HISTORICAL REMARKS			
IDENTICAL INSTRUMENTS FLOWN ON TIROS 4, 5, AND 6.			
66. DIAGRAMS			

35. SPECTRAL RANGE		0.4 TO 0.65 MICRONS NA		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
38. FIELD OF VIEW		74.0 BY 74.0 DEG 750 NM BY 750 NM FROM 475 NM ALTITUDE		39. GROUND SWATH			
40. ANGULAR RESOLUTION <sup>41</sup>		SPAT. RESOLUTION		42. POINTING RATE		43. ALTITUDE	
44. INCLINATION		45. INCLINATION		46. ALTITUDE		47. INCLINATION	
48. SPECIAL REQUIREMENTS		MED CIRCULAR MEDIUM POSTGRADE		49. POINTING RATE		50. ALTITUDE	
51. COMPONENTS		TV CAMERA, TRANSMITTER, TAPE RECORDER		52. AVERAGE POWER		53. STANDBY POWER	
54. WEIGHT		7 LB		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. INTERFERENCE		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
61. CALIBRATION		62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS		64. REFERENCES	
65. HISTORICAL REMARKS		IDENTICAL CAMERA FLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.		66. DIAGRAMS			

1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.\*\*\*  
 2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.\*\*\*3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.\*\*\*  
 4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966. \*\*\*5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.

NO IN-FLIGHT CALIBRATION DELAYED AND REALTIME DAYSIDE OF ORBIT FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RPT DATE		5. VERSION	
VIDICON CAMERA SYSTEM		VCSW				11/10/69		0004	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CONTRACT NUMBER		10. FLASH INDEX NUMBER	
RAMOS, R. N. (MGR.)		GODDARD SPACE FLT CENTER		301-982-5347		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		15. START DATE		16. COMPLETION DATE	
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
17. MONITOR		18. AGENCY		19. PGM OFFICE		20. TELEPHONE		21. STATUS	
GARBAZ, M.L.		NASA HDOTRS		OSSA/SRO		202-962-4291		POST FLIGHT	
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		26. LEAD TIME	
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		02/62 NA		27. INSTRUMENT TYPE		28. APPLICATION	
29. INSTRUMENT TYPE		30. SPACECRAFT		31. PURPOSE		32. INSTRUMENT TYPE		33. APPLICATION	
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON		TIROS 4		34. INSTRUMENT TYPE		35. APPLICATION		36. INSTRUMENT TYPE	
<p>PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS.***SECONDARY-TO TEST TV SENSOR IN SPACE.</p>									
<p>THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1. ON TIROS 1-8, 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELBERT F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 NM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>									
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

TIROS 5



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	VIDICON CAMERA SYSTEM		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			4. RESUME DATE	5. VERSION					
6. PRINCIPAL INVESTIGATOR	MEDIUM-ANGLE LENS		7. ORGANIZATION	8. TELEPHONE					
9. CO-INVESTIGATOR	RADOS, R.H. (HGR.)		10. ORGANIZATION	11. TELEPHONE					
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	GARBACZ, H.L.		19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT			
22. VENDOR	RCA ASTRO-ELECTRONICS		23. LOCATION	24. PROJECT	25. LEAD TIME				
26. INSTRUMENT TYPE	IMAGER, 0.5-INCH MEDIUM-ANGLE F/1.9 VIDICON		27. SERIAL NO.	28. APPLICATION	29. SPACECRAFT	UNC			
30. PURPOSE	TIROS 5								
<p>PRIMARY-TO PROVIDE PICTURES OF EARTH'S CLOUD COVER AND INVESTIGATE FORMATIVE STAGES OF HURRICANES AND ATMOSPHERIC MOTIONS. *** SECONDARY-TO CONFIRM THE CAPABILITY OF USING A WEATHER SATELLITE FOR ICE RECONNAISSANCE.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS MEDIUM ANGLE VIDICON CAMERA SYSTEM WAS ALSO FLOWN, IN IDENTICAL CONFIGURATION, ON TIROS 4 AND 6. IT CONSISTS OF A 1/2-INCH VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A MEDIUM ANGLE (76 DEGREES) TECEBA F/1.8 LENS PRODUCING A RESOLUTION OF ABOUT 1.0 MM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISECONDS AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 12 SECS. A MINIMUM INTERVAL, BETWEEN PICTURES, OF 10 SECONDS IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY FRAMED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SECONDS BY A 2-WATT PM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>									
32. PHENOMENA OBSERVED									
CLOUD COVER OVER THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	0.5	TO	0.65	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH				
40. ANGULAR RESOLUTION	56.0 BY	56.0	DEG	480 NM BY 480 NM FROM 450 NM ALTITUDE	
42. POINTING ACCURACY	0.12	DEG	1.0 NM PER TV-LINE FROM 450 NM ALTITUDE	44. ALTITUDE	45. INCLINATION
46. SPECIAL REQUIREMENTS	MED CIRCULAR MEDIUM POSIGRADE				
47. COMPONENTS					
TV CAMERA, TRANSMITTER, TAPE RECORDER					
48. WEIGHT	7 LB	49. VOLUME	9 WATTS	50. AVERAGE POWER	51. STANDBY POWER
52. PEAK POWER	53. MTRP	54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY				
60. IN-FLIGHT CALIBRATION	61. FREQUENCY OF OBSERVATION				
62. TELEMETRY REQUIREMENTS	63. ADVANTAGES AND LIMITATIONS				
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.					
64. REFERENCES					
1) SIGNIFICANT ACHIEVEMENTS IN SATELLITE METEOROLOGY, 1958-1964. NASA SP-96.***2) INSTRUMENTS AND SPACECRAFT, OCT 57-MAR 65. NASA SP-3028.***3) NASA NEWS RELEASES FOR TIROS 4, 5, 6. RELEASE NO'S 62-24; 62-136; 62-194.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CENTER (ESSA) ASHEVILLE, N.C.					
65. HISTORICAL REMARKS					
IDENTICAL INSTRUMENTS FLOWN ON TIROS 4, 5, AND 6.					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
VIDICON CAMERA SYSTEM									
1. TITLE	2. ACRONYM	3. EXP NO							
(TITLE CONT.)	VCSM	4. RESUME DATE							
WIDE-ANGLE LENS		11/10/69	0004						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
RADOS, R. M. (MGR.)	GODDARD SPACE FLT CENTER	301-982-5347							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
MONITOR					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARACZ, M.L.	NASA HDOTRS	OSSA/SRO	202-962-4291						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY	06/62	NA						
26. INSTRUMENT TYPE	27. APPLICATION								
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON	UNC								
28. APPLICATION	29. SPACECRAFT								
MET	TIROS 5								
30. PURPOSE									
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS. **SECONDARY-TO TEST TV SENSOR IN SPACE.									
31. PRINCIPLES OF OPERATION									
THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1. ON TIROS 1-8, 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELGETT F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 MM. THE CAMERA HAS A SHUTTER SPEED OF 1-5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.									
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	0.5 TO 0.65 MICRONS	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	74.0 BY 74.0 DEG	39. GROUND SWATH	740 NM BY 740 NM FROM 450 NM ALTITUDE
40. ANGULAR RESOLUTION	1.5 NM PER TV-LINE	41. ALTITUDE	450 NM ALTITUDE
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED CIRCULAR	MEDIUM POSIGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
TV CAMERA, TRANSMITTER, TAPE RECORDER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
7 LB		9 WATTS	9 WATTS
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. SHIELDING
SENSITIVE			MAGNETIC SHIELDING USED
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
NO. IN-FLIGHT CALIBRATION	DELATED AND REALTIME	DAYSIDE OF ORBIT	
59. TELEMETRY REQUIREMENTS			
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.			
60. ADVANTAGES AND LIMITATIONS			
BROAD SYNOPSIS VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OF NARROW ANGLE CAMERAS			
61. REFERENCES			
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***			
2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***			
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSAL-ASHEVILLE, NC.			
62. HISTORICAL REMARKS			
IDENTICAL CAMERA FLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.			
63. DIAGRAMS			

TIROS 6

TIROS 6

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
VIDICON CAMERA SYSTEM		VCSM		11/10/69 0004					
4. RESUME DATE		5. VERSION							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
RADOS, R. M. (MGR.)		GODDARD SPACE PLT CENTER		301-982-5347					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
17. STATUS		18. MONITOR		19. AGENCY		20. POM OFFICE		21. TELEPHONE	
GABACZ, M.L.		NASA-HDOTS		OSSA/SRO		202-962-4291		22. LEAD TIME	
23. LOCATION		24. DATE		25. LEAD TIME					
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		09/62 NA					
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. INSTRUMENT TYPE					
IMAGER, 0.5-INCH MEDIUM-ANGLE F/1.8 VIDICON		29. SPACECRAFT		30. PURPOSE					
MET		TIROS 6							
PRIMARY-TO PROVIDE PICTURES OF EARTH'S CLOUD COVER AND INVESTIGATE FORMATIVE STAGES OF HURRICANES AND ATMOSPHERIC MOTIONS.*** SECONDARY-TO CONFIRM THE CAPABILITY OF USING A WEATHER SATELLITE FOR ICE RECONNAISSANCE.									
31. PRINCIPLES OF OPERATION									
THIS MEDIUM ANGLE VIDICON CAMERA SYSTEM WAS ALSO PLOWN, IN IDENTICAL CONFIGURATION, ON TIROS 4 AND 5. IT CONSISTS OF A 1/2-INCH VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A MEDIUM ANGLE (76 DEGREES) TEGRA F/1.8 LENS PRODUCING A RESOLUTION OF ABOUT 1.0 MILE. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 12 SECS. A MINIMUM INTERVAL BETWEEN PICTURES, OF 10 SECONDS IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SECONDS BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.									
32. PHENOMENA OBSERVED									
CLOUD COVER OVER THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.5 TO 0.65 MICRONS NA					
38. FIELD OF VIEW		39. GROUND SWATH			
56.0 BY 56.0 DEG 450 NM BY 450 NM FROM 400 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.12 DEG .84 NM/TV LINE FROM 400 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		MEDIUM POSIGRADE	
47. COMPONENTS					
TV CAMERA, TRANSMITTER, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
7.1 LB				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. MAXIMUM INTERFERENCE		56. MAGNETIC SENSITIVE	
				57. INTERFERENCE	
58. SHIELDING		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
MAGNETIC SHIELDING USED					
NO IN-FLIGHT CALIBRATION DELAYED OR REALTIME DAY SIDE OF ORBIT					
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.					
63. ADVANTAGES AND LIMITATIONS					
BROAD SYNOPSIS VIEWING OF CLOUD COVER PATTERNS. VALUABLE FOR ICE STUDY AND ICE RECONNAISSANCE.					
64. REFERENCES					
1) SIG-ACHIEV. IN SAT. NET. 1958-1964. NASA SP-96.***2) INSTRUMENTS AND SPACECRAFT OCT 57-MAR 65. NASA SP-3028.***3) NASA NEWS RELEASES FOR TIROS 4, 5, 6. RELEASE NO'S. 62-24-62-136; 62-194.***4) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA) ASHEVILLE, N.C.					
65. HISTORICAL REMARKS					
IDENTICAL INSTRUMENTS PLOWN ON TIROS 4, 5, AND 6.					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ECONOMICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	VIDICON CAMERA SYSTEM		2. ACRONYM	3. EXP NO					
(TITLE CONT.)	WIDE-ANGLE LENS		4. RESUME DATE	5. VERSION					
6. PRINCIPAL INVESTIGATOR	GODDARD SPACE FLT CENTER		7. ORGANIZATION	8. TELEPHONE					
9. CO-INVESTIGATOR	RADOS, R. M. (MGR.)		10. ORGANIZATION	11. TELEPHONE					
12. CONTRACT NUMBER	13. CONTRACT INDEX NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT					
GARBACZ, A.L.	NASA	HQDTRS	OSSA/SRO	202-962-4291					
22. VENDOR	23. LOCATION	24. FILE NO	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, NEW JERSEY	09/62	NA						
26. INSTRUMENT TYPE									
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON									
28. APPLICATION	29. SPACECRAFT								
REX	TIROS 6								
30. PURPOSE									
<p>PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS.***SECONDARY-TO TEST TV SENSOR IN SPACE.</p>									
31. PRINCIPLES OF OPERATION	<p>THIS CAMERA SUB-SYSTEM HAS PLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10. AND SIMILAR CONFIGURATION ON ESSA 1. ON TIROS 1-8, 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELBERT F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 NM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>								
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE	7 TO 8 LEVELS OF GRAY								
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE	0.5 TO 0.65 MICRONS. NA		37. SPECTRAL RESOLUTION	38. TIME CONSTANT
39. FIELD OF VIEW	74.0 BY 74.0 DEG. 725 NM BY 725 NM FROM 400 NM ALTITUDE		40. GROUND SWATH	
41. ANGULAR RESOLUTION	0.2 DEG. 1.4 NM PER TV LINE FROM 400 NM ALTITUDE		42. SPATIAL RESOLUTION	
43. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION	
46. SPECIAL REQUIREMENTS	MED CIRCULAR MEDIUM POSIGRADE			
47. COMPONENTS				
TV CAMERA, TRANSMITTER, TAPE RECORDER				
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER	52. PEAK POWER
7 LB.		9 WATTS. NONE		9 WATTS
53. INTERFERENCE	54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY	60. FREQUENCY OF OBSERVATION		
		MAGNETIC SHIELDING USED		
NO. IN-FLIGHT CALIBRATION DELAYED AND REALTIME DAYSIDE OF ORBIT				
62. TELEMETRY REQUIREMENTS				
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.				
63. ADVANTAGES AND LIMITATIONS				
BROAD SYNOPTIC VIEWING OF CLOUD-COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS				
64. REFERENCES				
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***				
2) GOLDBERG, E.A. AND LONDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***				
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966. ***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.				
65. HISTORICAL REMARKS				
IDENTICAL CAMERA PLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.				
66. DIAGRAMS				

TIROS 7

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
ELECTRON TEMPERATURE PROBE		ETP		4. RESUME DATE		5. VARIATION			
(TITLE CONT.)		11/10/69		0003					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
SPENCER, M. V.		GODDARD SPACE FLT CENTER		301-982-5001					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
BRACE, L. H.		GODDARD SPACE FLT CENTER		301-982-4575					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. CONDITION	
								STATUS	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. POST FLIGHT	
GARBACK, M. L.		NASA HDQTRS		OSSA/SRO		202-962-4291			
23. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
				06/63		NA			
26. INSTRUMENT TYPE		27. RECORDS							
COUNTER, THERMAL-ELECTRON									
28. APPLICATION		29. SPACECRAFT		TIROS 7					
30. PURPOSE		PRIMARY-TO MEASURE IONOSPHERIC ELECTRON TEMPERATURE AND DENSITY, AND POSITIVE ION DENSITY OF THE PLASMA IN THE VICINITY OF THE SPACECRAFT.							
31. PRINCIPLES OF OPERATION									
<p>THE TIROS 7 ELECTRON TEMPERATURE PROBE IS SIMILAR TO THE PROBE FLOWN ON EXPLORER 11 AND 22. THE SENSOR CONSISTS OF A 5-INCH GUARD ELECTRODE AND A 9-INCH COLLECTOR OF 0.022-INCH DIAMETER MOUNTED ON THE SPACECRAFT BASEPLATE (PROJECTING INTO THE PLASMA). THE GUARD PREVENTS THE COLLECTION OF CURRENT IN THE REGION IMMEDIATELY ADJACENT TO THE SPACECRAFT AND THEREFORE AVOIDS ANY POSSIBLE RELATED DISTURBANCE OF THE MEASUREMENTS. AN APPROPRIATE SAW-TOOTH SHAPED VOLTAGE (-3 TO +5 VOLTS) IS APPLIED BETWEEN THE CYLINDRICAL ELECTRODE AND SATELLITE SHELL AND THE RESULTING CURRENT IS MONITORED. MAGNITUDE AND SHAPE OF THE CURRENT CURVE IS DETERMINED BY THE APPLIED VOLTAGE, THE ION AND ELECTRON CONTENT OF THE SATELLITE, PHOTO EMISSION OF THE ELECTRODE, AND THE AMBIENT ELECTRON AND ION TEMPERATURE. SINCE THE RELATIVE CONTRIBUTION OF THESE EFFECTS CAN BE EVALUATED, ELECTRON TEMPERATURE AND DENSITY, AND POSITIVE ION DENSITY MAY BE DEDUCED FROM ANALYSIS OF THE VOLT-AMPERE CURVES.</p>									
32. PHENOMENA OBSERVED									
AMBIENT THERMAL ELECTRONS AND IONS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
NA		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED CIRCULAR MEDIUM POSIGRADE	
45. SPECIAL REQUIREMENTS					
47. COMPONENTS					
GUARD ELECTRODE, COLLECTOR, POWER SOURCE					
48. WEIGHT		49. VOLUME		50. MTBF	
2 LB		2 HATTS		50. MTBF	
51. INTERFERENCE		52. INTERFERENCE		53. SHIELDING	
MAGNETIC		NUCLEAR		THERMAL	
54. CALIBRATION		55. DATA RECOVERY		56. FREQUENCY OF OBSERVATION	
SENSITIVE!		GUARD ELECTRODE PROVIDED			
PERIODIC RESISTOR MEAS		DELAYED TELEMETRY		CONTINUOUS	
60. TELEMETRY REQUIREMENTS					
ANALOG OUTPUT REQUIRES ABOUT 50 HZ RESPONSE OR 50 SAMPLES PER SECOND DIGITAL WORDS.					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) INSTRUMENTS AND SPACECRAFT-OCT 57-MAR 65. NASA SP-3028, 1966.**					
*2) MISSION PLAN TIROS 7, REPORT NO X-650-63-99, MAY 1963, NASA/GSEC.**3) SATELLITE AND ROCKET EXPERIMENTS DATA CATALOG. NASA/NATIONAL SPACE SCIENCE DATA CENTER, JAN. 68.**4) BRACE, L.H. AND REDDY, B.H.: EARLY ELECTROSTATIC PROBE RESULTS FROM EXPLORER 22. JGR-V.1, DEC. 1, 1965.**5) DATA AVAILABLE FROM NASA/GSEC/NESSDC.					
65. HISTORICAL REMARKS					
SIMILAR PROBE FLOWN ON EXPLORER 11 AND 22.					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER (TITLE CONT.)	1. IROB	4. RESUME DATE	5. VERSION						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
SUOMI, DR. V. E.	UNIVERSITY OF WISCONSIN	608-262-5938							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
PARENT, DR. R. J.	UNIVERSITY OF WISCONSIN	608-262-5938							
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARBACZ, M. L.	NASA HDOTRS	OSSA/SRO	202-962-4291						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
UNIVERSITY OF WISCONSIN	MADISON, WISCONSIN	06/63	NA						
26. INSTRUMENT TYPE									
RADIOMETER, IR OMNIDIRECTIONAL NON-SCANNING LOW-RESOLUTION									
27. SECURITY									
28. APPLICATION									
NET									
29. PURPOSE	TIROS 7								
<p>PRIMARY- TO MEASURE THE GROSS HEAT BUDGET OF THE EARTH.*** SECONDARY- TO DETERMINE HOW MUCH SOLAR ENERGY IS ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE AT THE UPPER BOUNDARY; THUS TO STUDY THE PRIME DRIVING FORCE OF THE CIRCULATION OF THE ATMOSPHERE.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS EXPERIMENT WAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 3, 4, AND 7, AND WAS ALSO SIMILAR TO ONE ON EXPLORER 7. TWO WIDE ANGLE (180 DEG FOV) LOW-RESOLUTION IR DETECTION DEVICES, EACH COMPOSED OF A BLACK-AND-WHITE BOLOMETER AND A REFLECTING MIRROR, ARE MOUNTED 180-DEGREES APART ON TELESCOPING SUPPORTS SO THAT THE SATELLITE DOES NOT INTERFERE WITH THE FIELD-OF-VIEW. THE MIRRORS SHIELD EACH SENSOR FROM DIRECT RADIATION EMITTED BY THE SATELLITE'S BODY. BOTH BOLOMETERS HAVE A HIGH ABSORPTIVITY TO THE IR RADIATION FROM THE EARTH. THE BLACK BOLOMETER ALSO HAS A HIGH ABSORPTIVITY FOR SOLAR RADIATION. THUS BOTH REFLECTED AND EMITTED RADIATION CAN BE MEASURED. THE TEMPERATURE OF THE HEMI-SPHERES IS GIVEN BY ATTACHED THERMISTORS. MATCHED PAIRS OF THERMISTORS ARE CONNECTED IN SERIES WITH SIMILAR SENSORS ON OPPOSITE SIDES OF THE SPACECRAFT; THEREFORE, THE MEASURED SENSOR TEMPERATURE RECEIVED FROM THE SATELLITE IS AN AVERAGE OF TWO TEMPERATURES FROM MATCHED THERMISTORS AND SIMULATES THE RESPONSE OF AN ISOLATED SPHERE IN SPACE. THE INFORMATION TELEMETERED TO EARTH INCLUDES TEMPERATURES OF THE MIRRORS AND SENSORS AND A FIXED RESISTANCE VALUE WHICH ALLOWS ONE TO COMPENSATE FOR DRIFT OF THE ELECTRONICS IN THE SATELLITE.</p>									
32. PHENOMENA OBSERVED									
RADIANT ENERGY REFLECTED AND EMITTED BY THE EARTH.									
33. MEASUREMENT RANGE									
128 DEG K TO 488 DEG K									
34. PRECISION AND ACCURACY									
0.1 KELVIN DEGREE									

36. SPECTRAL RANGE	0.3 TO 50.0 MICRON	37. TIME CONSTANT	5. SECONDS
38. FIELD OF VIEW	39. GROUND SWATH		
180.0	DEG 400 NM RADIUS CIRCLE FROM 400 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
NA	NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCINATION
NA	NA	MED CIRCULAR	MEDIUM POSIGRADE
46. SPECIAL REQUIREMENTS			
47. COMPONENTS			
2. DETECTION DEVICES, ELECTRONICS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
3 L.P.			
52. INTERFERENCE	53. INTERFERENCE	54. INTERFERENCE	55. INTERFERENCE
56. DATA RECOVERY	57. DATA RECOVERY	58. SHIELDING	59. SHIELDING
60. CALIBRATION	61. DATA RECOVERY	62. TELEMETRY REQUIREMENTS	63. TELEMETRY REQUIREMENTS
DATA FROM THIS AND OTHER IR EXPTS ON-BOARD ARE RECORDED CONTINUOUSLY FOR ONE ORBIT ON MAGNETIC TAPE FOR PLAYBACK ON COMMAND FROM ONE OF THE GROUND STATIONS.			
64. ADVANTAGES AND LIMITATIONS			
65. REFERENCES			
<p>1) HOUSE, P. B., RADIATION BALANCE OF THE EARTH FROM A SATELLITE, PHD THESIS, U. OF WISC. 1965.***2) VONDERHAAR, T. H., VARIATIONS OF THE EARTH'S RADIATION BUDGET, PHD THESIS, U. OF WISC. 1968.***3) MISSION PLAN TIROS 7, GSFC RPT NO. X-650-63-99, MAY 1963.***4) DATA AVAILABLE FROM NATIONAL SPACE SCIENCE DATA CENTER, NASA/GSFC.</p>			
66. HISTORICAL REMARKS			
IDENTICAL INSTRUMENT FLOWN ON TIROS 3, 4, AND 7; SIMILAR ON EXP 7			
67. DIAGRAMS			



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXT NO					
MEDIUM-RESOLUTION RADIONETER		MRR							
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
MCULLOCH, A.		GODDARD SPACE FLT CENTER		301-982-4347					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. POST FLIGHT	
GARRACK, R.L.		NASA HQ/ATRS		OSSA/SRO		202-962-4291			
23. VENDOR		24. LOCATION		25. LEAD TIME		26. INSTRUMENT TYPE		27. COMMENTS	
BARNES ENGINEERING CO		STANFORD, CONN.		06/63 NA					
28. INSTRUMENT TYPE		29. SPACECRAFT		30. PURPOSE					
RADIONETER, 5-CHANNEL THERMISTOR-BOLONETER		MED-RES SCANNING		UNC					
31. APPLICATION		32. PURPOSE		33. PURPOSE					
MET		TIROS 7							
<p>PRIMARY-TO MEASURE EMITTED THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN 5 SPECTRAL REGIONS. PARAME- TERS TO BE STUDIED ARE STRATOSPHERIC TEMPERATURES VIA THE 15 MICRON ABSORPTION BAND OF CO<sub>2</sub>, DAY-NIGHTTIME CLOUD COVER, ALBEDO, AND THERMAL RADIATION. TO GENERATE RADIATION MAPS FOR RESEARCH IN ATMOSPHERIC PROPERTIES.</p> <p>31. PRINCIPLES OF OPERATION</p> <p>TIROS 2, 3, 4, 7, AND NIMBUS 2 CONTAINED 5 CHANNEL SCANNING RADION- ETERS USING FILTERS AND BOLONETER DETECTORS. THE NIMBUS 2 RADI- OMETER, WHILE SIMILAR IN PURPOSE, WAS A NEW INSTRUMENT DESIGN. ON THE TIROS SERIES PRECISE BANDWIDTHS VARIED FOR EACH FLIGHT, FOR TIROS 7 THEY WERE: 14.8-15.5; 8.0-12.0; 0.2-6.0; 8.0-30.0; AND 0.55-0.75 MICRONS. A REFERENCE LEVEL WAS OBTAINED BY HAVING THE DETECTORS ALTERNATELY LOOK INTO SPACE AT 45 DEGREE ANGLE. EACH CHANNEL HAS THE SAME PRINCIPLE OF OPERATION: THE ALTERNAT- ING VOLTAGE GENERATED AT THE THERMISTOR BOLONETER IS PROPORTION- AL TO THE DIFFERENCE IN RADIATION ENERGY COMING FROM 2 OPPOSITE DIRECTIONS (THROUGH THE SATELLITE WALL AND BASE) AND IMPINGENT UPON A CHOPPER DISK THAT HAS ALTERNATE BLACK AND MIRRORRED HALVES. ALL 5 DISKS ROTATE SIMULTANEOUSLY AT 46 RPS AND HAVE IDENTICAL OUTPUT CIRCUITRY TO PREAMPLIFIERS AND TAPE RECORDERS. SATELLITE SPIN IS USED TO PROVIDE THE SCAN LINE, WHICH IS THEN ADVANCED BY ORBITAL MOTION OF THE SATELLITE. THE INSTRUMENT HAS A 5 DEG FOV FOR EACH CHANNEL. DATA ARE RECORDED ON THE SATEL- LITE'S ENDLESS LOOP OF MAGNETIC TAPE FOR A PERIOD OF 100 MIN.</p>									
32. PHENOMENA OBSERVED									
RADIATION FROM EARTH AND ATMOSPHERE IN 5 SPECTRAL REGIONS									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									
A S/N RATIO OF BETTER THAN 30 DB; ABSOLUTE ACCURACY OF +-7 DEG K									

38. SPECTRAL RANGE		39. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.25 TO 30.0 MICRONS SEE ITRM 31					
38. FIELD OF VIEW		39. GROUND SWATH			
5.0 DEG 35 NM DIAM CIRCLE FROM 400 NM ALTITUDE					
40. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION		42. POINTING ACCURACY		43. POINTING RATE	
5.0 DEG 35 NM AT CENTER FROM 400 NM ALTITUDE		44. ALTITUDE		45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		MEDIUM POSIGRADE	
47. COMPONENTS					
RADIONETER (5 THERMISTOR BOLONETER DETECTORS) - ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
6 LB		3 WATTS		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. SHIELDING	
55. MAGNETIC INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
SPACE LOOK FOR ZEROING		DELAYED TELEMETRY		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
7 FREQUENCY BANDS ARE USED FOR TOTAL IR PACKAGE (LOW + MED IR), THE 7 CHANNELS HAVE A WIDTH OF 310 HZ.					
63. ADVANTAGES AND LIMITATIONS					
AN UNCERTAINTY EXISTS IN THE ABSOLUTE VALUES OF THE MEASUREMENTS BECAUSE OF NO INFLIGHT CALIBRATION.					
64. REFERENCES					
1) TIROS 7 RADIATION DATA CATALOG AND USER'S MANUAL V.1, GSFC, SEPT 30, 64. ***2) DATA CATALOG OF SATELLITE AND ROCKET EXPTS. NSSDC 68-01, JAN 68. NASA/GSFC NATIONAL SPACE SCIENCE DATA CTR. ***3) MISSION PLAN TIROS 7, GSFC NO. X-650-63-99, NASA/GSFC, MAY 63. *** 4) GOLDBERG, I.: MET IR INSTRUMENTS FOR SATELLITES. NASA/GSFC, AUG. 68. ***5) DATA AVAILABLE FROM NAT SPACE SCIENCE DATA CTR, GSFC.					
65. HISTORICAL REMARKS					
SIMILAR RADIONETERS FLOWN ON TIROS 2, 3, 4, 7 AND NIMBUS 2 (MRR)					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
VIDICON CAMERA SYSTEM	VCSW								
(TITLE CONT.)	4. RESUME DATE	5. VISION DATE							
WIDE-ANGLE LENS	11/10/69	0004							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
RADOS, R.M. (SGR.)	GODDARD SPACE PLT CENTER	301-982-5347							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT NUMBER	13. CONTRACT INDEX NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT					
GABACZ, M.L.	NASA HOOBRS	OSSA/SRO	202-962-4291						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO ELECTRONICS	PRINCETON, NEW JERSEY	06/63	NA						
26. INSTRUMENT TYPE									
IMAGER, 0.5-INCH WIDE-ANGLE F/1.5 LOW-RESOLUTION VIDICON									
28. APPLICATION	29. SPACECRAFT								
NET	TIROS 7								
30. PURPOSE									
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS. ***SECONDARY-TO TEST TV SENSOR IN SPACE.									
31. PRINCIPLES OF OPERATION									
THIS CAMERA SUB-SYSTEM HAS PLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1, HOWEVER, ON THIS FLIGHT (TIROS 7) 2 WIDE ANGLE CAMERAS WERE USED. IT CONSISTS OF A 1/2 IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE ANGLE (105 DEG) ELGET F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 NM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLSEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SECS. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITES SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.									
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE	38. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.5 TO 0.65 MICRONS NA		
39. FIELD OF VIEW	39. GROUND SWATH	
74.0 BY 74.0 DEG 750 NM BY 750 NM FROM 475 NM ALTITUDE		
40. ANGULAR RESOLUTION (1) SPATIAL RESOLUTION		
0.2 DEG 1.5 NM PER TV-LINE FROM 475 NM ALTITUDE		
42. POINTING ACCURACY (2) POINTING RATE	44. ALTITUDE	43. SATELLITE OR
46. SPECIAL REQUIREMENTS	MED CIRCULAR MEDIUM POSIGRADE	
47. COMPONENTS		
TV CAMERA, TRANSMITTER, TAPE RECORDER		
48. WEIGHT	49. AVERAGE POWER	50. STANDBY POWER
7 LB	9 WATTS	9 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. INTERFERENCE
SENSITIVE		
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
NO IN-FLIGHT CALIBRATION DELAYED AND REALTIME DAYSIDE OF ORBIT		
57. TELEMETRY REQUIREMENTS		
PULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.		
58. ADVANTAGES AND LIMITATIONS		
BROAD SYNOPSIS VIEWING OF CLOUD-COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW-ANGLE CAMERAS.		
59. REFERENCES		
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***		
2) GOLDBERG, E.A. AND LONDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***		
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.		
60. HISTORICAL REMARKS		
IDENTICAL CAMERA PLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.		
61. DIAGRAMS		

TIROS 8

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
AUTOMATIC PICTURE-TRANSMISSION SYSTEM (TITLE CONT.)	APT								
4. RESUME DATE	5. VERSION								
11/10/69 10004									
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
STAMPFL, DR. R.A.	GODDARD SPACE FLT CENTER	301-982-6163							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
					POST FLIGHT				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
GARBACZ, M.L.	NASA HDOTRS	OSSA/SRO	202-963-429						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
RCA ASTRO-ELECTRONICS	PRINCETON, N.J.	12/63	NA						
26. INSTRUMENT TYPE									
IMAGER, 1-INCH AUTOMATIC-PICTURE-TRANSMISSION VIDICON									
28. APPLICATION	29. SPACECRAFT								
NET	TIROS 8								
30. PURPOSE									
PRIMARY-TO PROVIDE REAL TIME WIDE-ANGLE CLOUD COVER PICTURES FOR USE BY LOCAL USERS. **SECONDARY-TO CHECKOUT SENSORS TO BE USED IN FUTURE OPERATIONAL TOS FLIGHTS.									
31. PRINCIPLES OF OPERATION									
THE APT SYSTEM, CONSISTING OF A 1-IN VIDICON ARRANGMENT, WAS TEST FLOWN ON TIROS 8 AND NIMBUS 1 AND 2 (1 CAMERA), PRIOR TO OPERATIONAL TOS FLIGHTS: ESSA 2,4,6, AND TIROS M (2 CAMERAS). THE VIDICON USED INITIALLY (TIROS 8 AND NIMBUS 1), HAD A DIELECTRIC LAYER DEPOSITED ON THE GUN SIDE OF THE PHOTOCONDUCTOR TO STORE THE SCENE INFORMATION. HOWEVER, SINCE THE ELECTRON BEAM ALTERED THE ELECTRIC PROPERTIES OF THIS SURFACE, THE VIDICON WAS UPGRADED FOR FUTURE FLIGHTS. THE CAMERA UTILIZES A TEGEA-KINOPTIC, 108-DEG, WIDE-ANGLE, F/1.8 OBJECTIVE LENS WITH A 5.7 MM FL. THE SYSTEM AUTOMATICALLY TAKES AND TRANSMITS A PICTURE EVERY 208 SECS WHILE THE SATELLITE IS IN DAYLIGHT. OPTICAL EXPOSURE TIME IS 40 HILLISEC, GIVING SHEAR OF LESS THAN 10 PERCENT OF ONE PICTURE ELEMENT. AN 8-SECOND TURN-ON AND SYNC SIGNAL PRECEDES THE 200-SECOND TRANSMISSION, AT WHICH TIME THE VIDICON IS SCANNED AT 4 LINES PER SEC, PRODUCING AN 800-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. A 5-WATT TV TRANSMITTER BROADCASTS THE SIGNAL IN THE 136.95 MHZ BAND. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A RECORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE. APT IS COMPATIBLE WITH COMMERCIAL 240 RPM FAX EQUIPMENT.									
32. PHENOMENA OBSERVED									
CLOUD AND TERRAIN FEATURES APPROXIMATELY 1.7 NM OR LARGER									
33. MEASUREMENT RANGE									
DYNAMIC PICTURE RANGE OF 10:1									
34. PRECISION AND ACCURACY									
6 TO 10 LEVELS OF BRIGHTNESS VARIATION									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.45 TO 0.65 MICRON NA		
38. FIELD OF VIEW	39. GROUND SWATH	
89.0 BY 89.0 DEG 1200 NM BY 1200 NM FROM 450 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.16 DEG 1.7 NM FROM 450 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
1.0 DEG	0.1 DEG/SEC MED CIRCULAR	MEDIUM POSIGRADE
45. SPECIAL REQUIREMENTS		
46. COMPONENTS		
VIDICON, ELECTRONICS, TRANSMITTER, TAPE RECORDER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
24 LB		40 WATTS/200 HRS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
SENSITIVE SENSITIVE		MAGNETIC SHIELDING USED
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
57. FIDUCIAL MARKS INCLUDED REALTIME TELEMETRY CONTINUOUS DAYTIME		
58. TELEMETRY REQUIREMENTS		
PICTURE IS COMMUNICATED TO AN EARTH STATION IN THE SPACE RESEARCH BAND OF 136-137 MHZ. THE VIDEO OUTPUT REQUIRES 4 KHZ MAXIMUM BANDWIDTH CAPABILITY.		
59. ADVANTAGES AND LIMITATIONS		
DIRECT TRANSMISSION ON COMMAND TO MANY RECEIVERS WITHOUT INTERMEDIATE STORAGE. DIELECTRIC SURFACE OF VIDICON LIMITED TUBELIFE.		
60. REFERENCES		
1) SIG ACHIEV IN SAT MET 1958-1964. NASA SP-96.***2) STAMPFL, R. A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS, JOUR SMPT, VOL 73, FEB 1969.***3) OSTROW, H. AND WEINSTEIN, O.: REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY. PRESENTED AT 13TH ANNUAL TECH SYMP OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, AUG. 19-23, 1968.		
61. HISTORICAL REMARKS		
SIMILAR TO APT ON NIMBUS 1 AND 2. ESSA 2,4,6: SCHED FOR TIROS M		
62. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	VIDICON CAMERA SYSTEM		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			4. RESUME	5. VERSION					
6. PRINCIPAL INVESTIGATOR	WIDE-ANGLE LENS		11/10/69		0004				
7. ORGANIZATION	GODDARD SPACE FLT CENTER		301-982-5347						
8. CO-INVESTIGATOR	R. M. (RGR.)		9. TELEPHONE						
10. ORGANIZATION			11. TELEPHONE						
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. CONDITION	17. STATUS				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	POST FLIGHT					
GARACZ, M.L.	NASA HDOTRS	OSSA/SRO	202-963-4291						
22. VENDOR	23. LOCATION	24. FLIGHT	25. LEAD TIME						
BCA ASTRO-ELECTRONICS	PRINCETON, N. J.	12/63	NA						
26. INSTRUMENT TYPE	IMAGER, WIDE-ANGLE F/1.5 LOW-RESOLUTION		0.5-INCH VIDICON	UNC					
28. APPLICATION	29. SPACECRAFT								
HET	TIROS 8								
30. PURPOSE	PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS.***SECONDARY-TO TEST TV SENSOR IN SPACE.								
31. PRINCIPLES OF OPERATION	THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1. ON TIROS 1-8, 10 THE CAMERAS WERE ALIGNED PARALLEL TO THE S/C SPIN AXIS AND EXTENDED THROUGH THE BASE PLATE. IT CONSISTS OF A 1/2-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE-ANGLE (105 DEG) ELGETT F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 MM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SEC. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITE'S SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.								
32. PHENOMENA OBSERVED	CLOUD COVER AND THE EARTH'S SURFACE								
33. MEASUREMENT RANGE	7 TO 8 LEVELS OF GRAY								
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.5 TO 0.65 MICRONS		NA			
38. FIELD OF VIEW		39. GROUND SWATH			
74.0 BY 74.0 DEG		725 NM BY 725 NM		FROM 450 NM ALTITUDE	
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.2 DEG		1.4 NM PER TV-LINE		FROM 450 NM ALTITUDE	
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				MED CIRCULAR	
45. SPECIAL REQUIREMENTS		46. INCLINATION		POSIGRADE	
47. COMPONENTS					
TV CAMERA, TRANSMITTER, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
7 LB		9 WATTS		9 WATTS	
51. INTERFERENCE		52. NUCLEAR THERMAL		53. SHIELDING	
SENSITIVE		54. INTERFERENCE		55. DATA RECOVERY	
56. CALIBRATION		57. INTERFERENCE		58. MAGNETIC SHIELDING USED	
NO IN-FLIGHT CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
61. TELEMETRY REQUIREMENTS		62. DATA RECOVERY		63. FREQUENCY OF OBSERVATION	
FULL REEL OF 32 PICTURES CAN BE READ OUT IN 100 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.					
64. ADVANTAGES AND LIMITATIONS					
BROAD SYNOPTIC VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS					
65. REFERENCES					
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***					
2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***					
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.					
66. HISTORICAL REMARKS					
IDENTICAL CAMERA FLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.					
67. DIAGRAMS					

TIROS 9

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. VCSU		5. VERSION	
VIDICON CAMERA SYSTEM		VCSU		11/10/69 0004		VCSU		11/10/69 0004	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
RADOS, R. H. (MGR.)		GODDARD SPACE PLT CENTER		301-982-5347					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. START DATE		15. STATUS		16. POST FLIGHT	
17. MONITOR		18. AGENCY		19. PGM OFFICE		20. TELEPHONE		21. POST FLIGHT	
GABACZ, M.L.		NASA HQ/OTRS		OSSA/SRO		202-963-429			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME		26. SECURITY	
RCA ASTRO-ELECTRONICS		PRINCETON, N. J.		101/65 NA				UNC	
27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. TIROS 9	
IMAGER, WIDE-ANGLE F/1.5. LOW-RESOLUTION 0.5-INCH VIDICON									
<p>PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS. ***SECONDARY-TO TEST TV SENSOR IN SPACE.</p>									
<p>THE TIROS 9 WIDE ANGLE TV CAMERA WAS IDENTICAL TO THOSE CARRIED ON ALL TIROS MISSIONS AND ESSA 1. HOWEVER, THIS FLIGHT CARRIED 2. IN A NEW CONFIGURATION (CARTHEEL), MOUNTED ON THE SIDE OF THE SPACECRAFT AND CANTED 26 DEG TO EACH SIDE OF THE PLANE OF THE SATELLITE'S ROTATION (TORP). EACH CAMERA WAS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN VIEWING THE EARTH (ONCE EACH ORBIT). EACH CAMERA CONSISTS OF A 1/2-INCH VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TV-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON COMMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 48 PICTURES ON MAGNETIC TAPE FOR LATER TRANSMISSION. THE CAMERA HAS A WIDE-ANGLE (105 DEG) ELGET F/1.5 LENS. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SECS. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. TRANSMISSION OF THE ENTIRE REEL OF 48 PICTURES CAN BE ACCOMPLISHED IN 120 SECONDS USING A 5-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>CLOUD COVER AND THE EARTH'S SURFACE</p>									
<p>33. MEASUREMENT RANGE</p> <p>7 TO 8 LEVELS OF GRAY</p>									
<p>34. PRECISION AND ACCURACY</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.5 TO 0.65 MICRONS NA					
38. FIELD OF VIEW		39. GROUND SWATH			
74.0 BY 74.0 DEG		750 NM BY 750 NM FROM 500 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.2 DEG		1.5 NM PER TV LINE FROM 500 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
				MED ECCENTRIC MEDIUM POSIGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
TV CAMERA, TRANSMITTER, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
7 LB				9 WATTS NONE	
51. INTERFERENCE		52. INTERFERENCE		53. SHIELDING	
MAGNETIC SENSITIVE		MAGNETIC SENSITIVE		MAGNETIC SHIELDING USED	
54. CALIBRATION		55. DATA RECOVERY		56. FREQUENCY OF OBSERVATION	
NO IN-FLIGHT CALIBRATION DELAYED AND REALTIME		DAYSIDE OF ORBIT			
57. TELEMETRY REQUIREMENTS					
PULL REEL OF 48 PICTURES CAN BE READ OUT IN 120 SECONDS USING AN FM TRANSMITTER OPERATING AT FREQUENCY OF 235 MHZ.					
58. ADVANTAGES AND LIMITATIONS					
BROAD SYNOPSIS VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS					
59. REFERENCES					
1) SIGNIFICANT ACHIEVEMENTS IN SAT MET 1958-1964. NASA SP-96.***					
2) GOLDBERG, E.A. AND LANDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***					
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966.***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.					
60. HISTORICAL REMARKS					
BASIC CAMERA IDENTICAL TO THOSE FLOWN ON TIROS 1-10 AND ESSA 1.					
61. DIAGRAMS					

TIROS 10



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE									
VIDICON CAMERA SYSTEM									
2. ACRONYM 3. EXP NO									
VCSW									
4. RESUME DATE									
11/10/69 0005									
5. VISION DATE									
6. WIDE-ANGLE LENS									
7. ORGANIZATION									
GODDARD SPACE FLT CENTER 301-982-5347									
8. PRINCIPAL INVESTIGATOR									
RADOS, R.M. (MGR.)									
9. CO-INVESTIGATOR									
10. ORGANIZATION									
11. TELEPHONE									
12. CONTRACT TYPE									
13. CONTRACT NUMBER									
14. FLASH INDEX NUMBER									
15. START DATE									
16. COMPLETION DATE									
17. STATUS									
18. MONITOR									
19. AGENCY									
20. PCM OFFICE									
21. TELEPHONE									
22. VENDOR									
23. LOCATION									
24. FLIGHT DATE									
25. LEAD TIME									
26. INSTRUMENT TYPE									
RCA ASTRO ELECTRONICS PRINCETON, N. J.									
27. JURY									
28. APPLICATION									
29. SPACECRAFT									
30. PURPOSE									
TIROS 10									
PRIMARY-TO ACQUIRE AND TRANSMIT PICTURES OF THE EARTH'S CLOUD COVER TO PROVIDE METEOROLOGISTS WITH DETAILED INFORMATION ON INDIVIDUAL CLOUD TYPES OVER SPECIFIC AREAS. ***SECONDARY-TO TEST TV SENSOR IN SPACE.									
31. PRINCIPLES OF OPERATION									
THIS CAMERA SUB-SYSTEM HAS FLOWN IN AN IDENTICAL CONFIGURATION ON TIROS 1-10 AND SIMILAR CONFIGURATION ON ESSA 1. HOWEVER, ON THIS FLIGHT, TWO WIDE-ANGLE CAMERAS WERE USED. EACH CONSISTS OF A 0.5-IN VIDICON TUBE AND A FOCAL-PLANE SHUTTER THAT PERMITS STORAGE OF STILL PICTURES ON THE TUBE SCREEN. AN ELECTRON BEAM CONVERTS THE STORED PICTURES INTO TELEVISION-TYPE ELECTRONIC SIGNALS, WHICH CAN BE TRANSMITTED TO GROUND RECEIVERS ON DEMAND. THE SYSTEM CAN ALSO PROCESS AND STORE UP TO 32 PICTURES ON MAGNETIC TAPE FOR TRANSMISSION AT A LATER TIME. THE CAMERA HAS A WIDE-ANGLE (105 DEG) ELGRET F/1.5 LENS PRODUCING A RESOLUTION OF 1.4 TO 2.0 MM. THE CAMERA HAS A SHUTTER SPEED OF 1.5 MILLISEC AND A VIDEO-BANDWIDTH OF 62.5 KHZ. THE 500 LINE FRAME IS PROCESSED FOR STORAGE IN 2 SECS. A MINIMUM INTERVAL OF 10 SEC BETWEEN PICTURES IS REQUIRED FOR THE TARGET IMAGE TO BE ELECTRICALLY ERASED. THE CAMERA IS ALIGNED PARALLEL TO THE SATELLITES SPIN AXIS AND IS AUTOMATICALLY TRIGGERED SO AS TO BE IN A PICTURE TAKING MODE ONLY WHEN DIRECTED TOWARD THE EARTH. TRANSMISSION OF THE ENTIRE REEL OF 32 PICTURES CAN BE ACCOMPLISHED IN 100 SEC BY A 2-WATT FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ.									
32. PHENOMENA OBSERVED									
CLOUD COVER AND THE EARTH'S SURFACE									
33. MEASUREMENT RANGE									
7 TO 8 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE									
0.5 TO 0.65 MICRONS NA									
36. SPECTRAL RESOLUTION									
37. TIME CONSTANT									
38. FIELD OF VIEW									
39. GROUND SWATH									
74.0 BY 74.0 DEG 725 NM BY 725 NM FROM 450 NM ALTITUDE									
40. ANGULAR RESOLUTION-AT SPATIAL RESOLUTION									
0.2 DEG 1.4 NM PER TV-LINE FROM 450 NM ALTITUDE									
41. POINTING ACCURACY									
42. POINTING RATE									
43. ALTITUDE									
44. INCLINATION									
45. POSIGRADE									
46. SPECIAL REQUIREMENTS									
47. COMPONENTS									
TV CAMERA, TRANSMITTER, TAPE RECORDER									
48. WEIGHT									
49. VOLUME									
50. AVERAGE POWER									
51. STANDBY POWER									
52. PEAK POWER									
53. MTBF									
54. INTERFERENCE									
55. INTERFERENCE									
56. INTERFERENCE									
57. INTERFERENCE									
58. SHIELDING									
59. CALIBRATION									
60. DATA RECOVERY									
61. FREQUENCY OF OBSERVATION									
62. TELEMETRY REQUIREMENTS									
63. ADVANTAGES AND LIMITATIONS									
BROAD SYNOPSIS VIEWING OF CLOUD COVER PATTERNS. MORE VALUABLE DATA FOR WEATHER ANALYSIS THAN FROM MED OR NARROW ANGLE CAMERAS.									
64. REFERENCES									
1) SIGNIFICANT ACHIEVEMENTS IN SAT NET 1958-1964. NASA SP-96.***									
2) GOLDBERG, E.A. AND LONDON, V.D.: KEY EQUIP FOR TIROS 1. ASTRO-NAUTICS, V.5, JUNE 1960.***3) MESNER, M.H. AND STANISZEWSKI, J.: TV CAMERAS FOR SPACE EXPLOR. ASTRONAUTICS, V.5, MAY 1960.***									
4) INSTRUMENTS AND SPACECRAFT. NASA SP-3028, 1966. ***5) DATA AVAILABLE FROM NATIONAL WEATHER RECORDS CTR (ESSA), ASHEVILLE, NC.									
65. HISTORICAL REMARKS									
IDENTICAL CAMERA FLOWN ON TIROS 1-10. SIMILAR CAMERA ON ESSA 1.									
66. DIAGRAMS									

TIROS M

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
ADVANCED VIDICON CAMERA SYSTEM (TITLE CONT.)		AVCS		4. REFERENCE DATE		5. VERSION			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR			
OBBIEN, J. (TECH MON)		GODDARD SPACE FLT CENTER		301-982-5348					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. START DATE		15. STATUS			
						COMPLETION DATE		17. INTEGRATION	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE			
GARBACZ, M.I.		NASA HQ/RTS		OSSA/SRO		202-963-4291			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.				NA			
26. INSTRUMENT TYPE		27. CAMERA		28. APPLICATION		29. SECURITY			
IMAGER, HIGH-RESOLUTION WIDE-ANGLE 1-INCH VIDICON CAMERA						UNC			
30. PURPOSE		31. TIROS M		32. SPACECRAFT		33. APPLICATION			
MET, BRSP									
<p>PRIMARY-TO PROVIDE METEOROLOGICAL DATA IN THE FORM OF WIDE-ANGLE HIGH-RESOLUTION TELEVISION PICTURES OF EARTH'S CLOUD COVER.*** SECONDARY-TO MAINTAIN OPERATIONAL CAPABILITY OF THE AVCS.</p>									
<p>21. PRINCIPLES OF OPERATION</p> <p>THE AVCS FOR TIROS M IS BASICALLY SIMILAR TO THE SYSTEMS TEST FLOWN ON NIMBUS 1 AND 2 AND OPERATIONALLY FLOWN ON ESSA 3 AND 5. THE TIROS M SYSTEM CONSISTS OF 2 IDENTICAL 1-IN VIDICONS HAVING 833 TV LINE RESOLUTION WITH ONLY 1 IN OPERATION AT ANY GIVEN TIME. THE CAMERAS ARE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT AND LOOK AT THE NADIR DURING PICTURE-TAKING SEQUENCES. THE LENS IS A TRIGEA-KINOPTIC, 108 DEG, WIDE-ANGLE, F/1.8, 5.7 MM LENS USING AN ELECTROMAGNETICALLY CONTROLLED SHUTTER. THE VIDICON IS A "HYBRID VIDICON" WHICH IS ELECTROSTATICALLY FOCUSED AND MAGNETICALLY DEFLECTED. IT HAS AN INHERENT STORAGE PROPERTY WHICH PERMITS A NOMINAL 6.5 SEC FRAME SCAN TIME. A GRAY-SCALE CALIBRATION ASSEMBLY, UTILIZING AN INCANDESCENT LAMP AS A LIGHT SOURCE, PROVIDES 15 LINEAR DENSITY STEPS. THE LIGHT OUTPUT IS DIRECTED THROUGH THE GRAY-SCALE TRANSPARENCY BY MEANS OF A LENS AND PRISM ARRANGEMENT AND IMPRESSED ON THE VIDICON PHOTO CONDUCTOR. THE GRAY-SCALE SERVES AS A REFERENCE WHEN THE TV PICTURES ARE PROCESSED ON THE GROUND. A COMPLETE PICTURE SEQUENCE LASTS ABOUT 48 MIN, DURING WHICH 11 PICTURES ARE TAKEN AT INTERVALS OF 260 SEC (GIVING AN OVERLAP OF 50 PERCENT) AND STORED IN A 3-CHANNEL TAPE RECORDER FOR LATER TRANSMISSION.</p> <p>32. PHENOMENA OBSERVED</p> <p>CLOUD COVER OF EARTH (REFLECTED VISIBLE SOLAR RADIATION)</p> <p>33. MEASUREMENT RANGE</p> <p>DYNAMIC RANGE OF 200 TO 10,000 FOOT-LAMBERTS</p> <p>34. PRECISION AND ACCURACY</p> <p>833-LINE RESOLUTION, 15-16 LEVELS OF GRAY</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.4 TO 0.65 MICRON NA					
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG		1700 NM BY 1700 NM FROM 750 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.13 DEG		1.7 NM PER TV-LINE AT THE CENTER FROM 750 NM ALT			
42. POINTING ACCURACY		43. POINTING RATE		45. INCLINATION	
NA		MED CIRCULAR		RETROGRADE	
46. SPECIAL REQUIREMENTS		47. COMPONENTS			
2 TV CAMERAS, 2 TAPE RECORDERS, SYSTEM ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
63 LB		NA		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. SHIELDING	
MAGNETIC SENSITIVE		MAGNETIC SENSITIVE		MAGNETIC SHIELDING USED	
55. CALIBRATION		56. DATA RECOVERY		57. FREQUENCY OF OBSERVATION	
GRAY-SCALE CALIBRATION		DELAYED AND REALTIME		DAYSIDE OF ORBIT	
58. TELEMETRY REQUIREMENTS		59. ADVANTAGES AND LIMITATIONS			
THE AVCS VIDEO SIGNAL HAS A BASEBAND OF 60 KHZ, WITH ITS DATA MADE UP OF DISCRETE FRAMES.					
60. REFERENCES		61. HISTORICAL REMARKS		62. DIAGRAMS	
7) DESIGN STUDY REPORT FOR THE IMPROVED TOS (ITOS) SYSTEM, V.1-3, RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, JUN 7, 68. ***2) FINAL ENGINEERING REPORT TOS A, VOL 1, 2, 3. RCA ASTRO-ELECTRONICS DIV. CONTRACT NO. NAS5-9034, MAY 5, 1967. ***3) ESSA PRESS RELEASE FOR ESSA 3, ES 66054, SEPT. 19, 1966. ***4) SIG. ACHIEV. IN SPACE APP. 1966, NASA SP-156, 1967.		SIMILAR TO AVCS ON NIMBUS 1 AND 2, AND ESSA 3 AND 5.			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
AUTOMATIC PICTURE-TRANSMISSION SYSTEM (TITLE CONT.)		APT		4. RESUME		5. VERSION			
		11/10/69 0004							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
OBRIEN, J. (TECH MON)		GODDARD SPACE FLT CENTER		301-982-5348					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
GABRACZ, M.L.		NASA HDQTRS		OSSA/SRO		202-963-429		INTEGRATION	
23. VENDOR		23. LOCATION		24. START DATE		25. LEAD TIME		26. DATE	
28. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION	
RCA ASTRO-ELECTRONICS		PRINCETON, N.J.		VIDICON		TIROS M		<p>THE APT CAMERA SUBSYSTEM HAS ALSO BEEN FLOWN PREVIOUSLY ON TIROS 8, NIMBUS 1, AND ESSA 2, 4, 6 IN SIMILAR CONFIGURATION. THE TIROS M SUBSYSTEM WILL CONSIST OF 2 IDENTICAL 1-INCH VIDICON APT CAMERAS, EACH UTILIZING A TEGRA-KINOPTIC, 108-DEG, WIDE-ANGLE, F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. ONLY ONE CAMERA IS UTILIZED FOR OPERATION DURING ANY PICTURE-TAKING SEQUENCE. THE APT SUBSYSTEM IS CONTROLLED BY GROUND-INITIATED COMMANDS THAT ARE TRANSMITTED TO AND STORED BY THE SATELLITE. ONCE THE SEQUENCE IS INITIATED, THE CAMERA WILL TAKE A PICTURE ONCE EVERY 260 SEC UNTIL THE PRESCRIBED 11 PICTURES HAVE BEEN TAKEN. THE ACTUAL PICTURE TAKING REQUIRES 8 SEC WITH AN EXPOSURE TIME OF 25 MILLI-SEC, AND THE TRANSMISSION 150 SECS. DURING THIS LATTER PERIOD THE VIDICON IS SCANNED AT 4 LINES PER SEC. AND THE SIGNALS TRANSMITTED PRODUCING AN 600-LINE PICTURE WITH SCAN LINES PERPENDICULAR TO THE ORBIT TRACK. TWO 5-WATT TV TRANSMITTERS ARE USED, EACH PROVIDING A 137.62 MHZ CARRIER. AN APT GROUND STATION WITH AN APPROPRIATE ANTENNA, RECEIVER, AND A RECORDER CAN RECEIVE THESE PICTURES WHEN THE SPACECRAFT IS WITHIN ACQUISITION RANGE.</p>	
32. PHENOMENA OBSERVED		CLOUD AND TERRAIN FEATURES OF APPROX 3.4 NM OR LARGER							
33. MEASUREMENT RANGE		DYNAMIC PICTURE RANGE OF 20:1							
34. PRECISION AND ACCURACY		S/N OF 32 DB, MINIMUM; 8 GRAY LEVELS CAN BE RESOLVED							

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.45 TO 0.65 MICRON NA					
38. FIELD OF VIEW		39. GROUND SWATH			
89.0 BY 89.0 DEG 1700 NM BY 1700 NM FROM 750 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.25 DEG 13.4 NM PER TV-LINE AT CENTER FROM 750 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		47. COMPONENTS		48. WEIGHT	
				49. VOLUME	
		50. AVERAGE POWER		51. STANDBY POWER	
		52. PEAK POWER		53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
57. SENSITIVE		58. SHIELDING		59. CALIBRATION	
60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS	
63. ADVANTAGES AND LIMITATIONS		64. REFERENCES		65. HISTORICAL REMARKS	
CAMERAS (2), ELECTRONICS (2)		REALTIME TELEMETRY		DAYTIME ON COMMAND	
<p>THE VIDEO OUTPUT, TURN-ON, AND PHASING CODE DRIVE A MODULATOR WHOSE AMPLITUDE MODULATES THE 2400 HZ SUBCARRIER, WHICH IN TURN MODULATES THE 137.62 MHZ CARRIER.</p> <p>AN IMPROVED DOUBLE-BLADED, SOLENOID-ACTUATED SHUTTER WILL BE USED ON THIS APT. REVISED TIMING TO PROVIDE 11 PICTURES FROM 1 CAMERA</p> <p>1) DESIGN STUDY REPORT FOR THE IMPROVED TOS (ITOS) SYSTEM, VOL. 1, 2, RCA ASTRO-ELECTRONICS CONTRACT NO. NAS 5-9032, JUNE 7, 66.***2)</p> <p>APT USER'S GUIDE, ESSA, NAT WEATHER SAT CTR, 1965.***3) STAMPPL, R.A. AND STROUD, W.G.: THE APT TV CAMERA SYSTEM FOR MET SATS, NASA TN D-1915, NOV. 1963.***4) FINAL ENGINEERING REPORT, TOS/OT-2, RCA CORP., MAY, 1967.</p>					
56. DIAGRAMS					



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
SCANNING RADIONETER		SR							
(TITLE CONT.)		4. DATE		5. VERSION					
		11/10/69		0004					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
GROUNDER, G. (T MON)		GODDARD SPACE FLT CENTER		301-986-5716					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. COMPLETION DATE		17. STATUS	
								INTEGRATION	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE			
GARBAR, H.L.		NASA HQ/RTS		OSSA/SRO		202-963-4291			
22. VENDOR		23. LOCATION		24. DATE		25. LEAD TIME			
SANTA BARBARA RES CENTER GOLETA, CALIF				NA					
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT			
RADIONETER, VISIBLE/IR SCANNING						TIROS M		UNC	
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY	
HET, ATH-PHYS, PART-PLD		PRIMARY-TO MEASURE EMITTED RADIATION FROM THE EARTH DURING DAY AND NIGHT AND TO MEASURE REFLECTED RADIATION FROM THE EARTH DURING DAYTIME. THE SYSTEM PERMITS DETERMINATION OF THE SURFACE TEMPERATURE OF THE GROUND, SEA, OR CLOUD TOPS THAT ARE VIEWED BY THE RADIONETER.		ENERGY IN THE INFRARED AND VISIBLE REGION OF THE SPECTRUM		VISIBLE BRIGHTNESS: 20-8500 FT-LAMBERT; IR TEMP: 185-330 DEG K		1.0 K DEG AT 300 DEG K; 4.0 K DEG AT 185 DEG K	
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE		34. PRECISION AND ACCURACY	
HET, ATH-PHYS, PART-PLD		PRIMARY-TO MEASURE EMITTED RADIATION FROM THE EARTH DURING DAY AND NIGHT AND TO MEASURE REFLECTED RADIATION FROM THE EARTH DURING DAYTIME. THE SYSTEM PERMITS DETERMINATION OF THE SURFACE TEMPERATURE OF THE GROUND, SEA, OR CLOUD TOPS THAT ARE VIEWED BY THE RADIONETER.		ENERGY IN THE INFRARED AND VISIBLE REGION OF THE SPECTRUM		VISIBLE BRIGHTNESS: 20-8500 FT-LAMBERT; IR TEMP: 185-330 DEG K		1.0 K DEG AT 300 DEG K; 4.0 K DEG AT 185 DEG K	

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.52 TO 12.5 MICRONS					
38. FIELD OF VIEW		39. GROUND SWATH			
150.0 DEG		LIMB-TO-LIMB (4100 NM) FROM 750 NM ALT			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.4 DEG		4.1 NM FROM 750 NM ALTITUDE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		MED CIRCULAR		SUN-SYNCH RETROGRADE	
47. COMPONENTS		RADIOMETER MUST BE ABLE TO SCAN 150 DEG WITHOUT OBSTRUCTIONS			
2 RADIONETER-ELECTRONICS SYSTEMS, PROCESSOR, TAPE RECORDER		50. AVERAGE POWER		51. STANDBY POWER	
48. WEIGHT		50. VOLUME		51. STANDBY POWER	
40 LB		14 WATTS		53. MTBF	
54. INTERFERENCE		55. MAGNETIC		56. NUCLEAR	
		57. INTERFERENCE		58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
2 COLD, 1 HOT EACH SCAN		DELATED AND REALTIME NIGHTTIME/DAYTIME			
62. TELEMETRY REQUIREMENTS		BASEBAND BANDWIDTH IS 7.2 KHZ.			
63. ADVANTAGES AND LIMITATIONS		HIGHER CALIBRATION ACCURACY IN VISIBLE THAN PRESENT CAMERAS, NOT SUBJECT TO SHADING, PROVIDES DAY AND NIGHT REALTIME IR DATA.			
64. REFERENCES		1) DESIGN STUDY REPORT FOR THE IMPROVED TOS (ITOS) SYSTEM, V. 1.2, 3. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS5-9034, JUNE 7, 68.***2) GOLDBERG, I.: METEOROLOGICAL IR INSTRUMENTS FOR SATELLITES, PRESENTED AT 13TH ANNUAL TECH. SYMP. OF SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, AUG. 22, 1968.			
65. HISTORICAL REMARKS		SCHEDULED FOR LAUNCH IN 1970			
66. DIAGRAMS					

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
(TITLE CONT.)		SPM		4. RESUME DATE		5. VERSION			
		11/10/69		0005					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
BOSTROM, C. O.		APPLIED PHYSICS LAB		301-776-7100					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
WILLIAMS, D. J.		GODDARD SPACE PLT CENTER		301-982-5808					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. STAFF NO.		16. STATUS	
		ESSA ES-86-67		11/66		INTEGRATION			
16. MONITOR		17. AGENCY		18. PGM OFFICE		19. TELEPHONE			
SIOMKAJLO, J.		ESSA/NESC							
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
APPLIED PHYSICS LAB		SILVER SPRING, MARYLAND		NA					
26. INSTRUMENT TYPE		27. APPLICATION		28. SPACECRAFT		29. PART-FLD		30. PURPOSE	
COUNTER, SOLID-STATE DETECTOR-ARRAY				TIROS M				UNC	
PRIMARY-TO DETECT SOLAR PROTONS OVER AN EXTENDED PERIOD OF TIME IN THE VICINITY OF THE EARTH FOR: 1. EARLY WARNING OF THE OCCURRENCE OF SOLAR-PROTON EVENTS; 2. SYSTEMATIC MONITORING OF PROTON INTENSITIES AND SPECTRA; 3. RESEARCH IN SOLAR-TERRESTRIAL PHYSICS.									
31. PRINCIPLES OF OPERATION THE SPM CONSISTS OF 6 SOLID STATE DETECTORS. DETECTORS 1, 2, 3 & 6 ARE MOUNTED ON THE SPACECRAFT SO THAT THE AXES OF THE POV ARE NEARLY PARALLEL TO THE EARTH'S MAGNETIC FIELD NEAR THE MAGNETIC POLES. DETECTORS 4 AND 5 ARE MOUNTED SUCH THAT THE AXES OF THEIR POV ARE APPROXIMATELY PERPENDICULAR TO THE EARTH'S MAGNETIC FIELD EVERYWHERE. DETECTORS 1 AND 2 ARE SHIELDED BY HEMISPHERES, THE THICKNESS OF WHICH DETERMINES THE MINIMUM PROTON ENERGY REACHING THE DETECTOR. DETECTOR 1 IS SENSITIVE TO PROTONS ABOVE 60 MEV, AND DETECTOR 2 IS SENSITIVE TO PROTONS ABOVE 30 MEV. DETECTOR 3 IS SENSITIVE TO PROTONS ABOVE 10 MEV AND CONSISTS OF A LITHIUM-DRIFTED SOLID-STATE CUBE-SHAPED DETECTOR SURROUNDED BY AN ALUMINUM SHIELD. DETECTORS 1, 2, AND 3 EACH HAVE A POV OF 2 PI STERADIANS. DETECTORS 5 AND 6 EACH EMPLOY 2 DISK-SHAPED DETECTORS OF THE FULLY-DEPLETED, SURFACE-BARRIER TYPE, AND MEASURE PROTON ENERGIES BETWEEN 0.3 AND 10 MEV. EACH HAS A POV OF 40 DEGREES. DETECTOR 4, WITH A POV OF 15 DEGREES, COUNTS ELECTRONS ABOVE 50 KEV AND CONSISTS OF A 700 MICRON-THICK SURFACE-BARRIER DETECTOR. EACH DETECTOR HAS A PREAMPLIFIER-AMPLIFIER-DISCRIMINATOR UNIT ASSOCIATED WITH IT.									
32. PHENOMENA OBSERVED SOLAR PROTONS AND ALPHA-PARTICLES OVER THE POLAR CAPS									
33. MEASUREMENT RANGE SEE ITEM 31									
34. PRECISION AND ACCURACY SEE ITEM 31									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
NA		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
SEE ITEM 31		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		POLAR	
45. SPECIAL REQUIREMENTS		46. INCLINATION		NA	
DETECTORS SHOULD BE MAINTAINED BETWEEN -25 AND +25 DEGREES C.					
47. COMPONENTS					
DETECTORS, AMPLIFIERS, AND DISCRIMINATORS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
5 LB		0.1 CU FT		2 WATTS	
51. INTERFERENCE		52. INTERFERENCE		53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. SHIELDING			
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
PRE-FLIGHT CALIBRATION		DELAYED AND REALTIME		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
DATA FRAME COMPRISES 20 NINE-BIT WORDS, FRAME TIME IS 12 SECS, WHICH CORRESPONDS TO 15 BITS/SEC. A DIGITAL ENCODER ASSIMILATES THE DATA FOR TRANSMISSION.					
63. ADVANTAGES AND LIMITATIONS					
WITH REAL TIME TELEMETRY EARLY WARNING OF INCREASE IN SOLAR PROTON INTENSITY COULD BE TRANSMITTED.					
64. REFERENCES					
1) BOSTROM, C.O. AND WILLIAMS, D.J.: PROPOSAL FOR SOLAR PROTON MONITOR FOR TIROS OPERATIONAL SAT. APPLIED PHYS LAB, AND GSFC. ***2) DESIGN STUDY REPORT FOR THE ITOS SYSTEM, VOL. 1, 2. RCA ASTRO-ELECTRONICS, CONTRACT NO. NAS 5-9034, 1968.					
65. HISTORICAL REMARKS					
SCHEDULED FOR LAUNCH EARLY IN 1970.					
66. DIAGRAMS					

PART 2

APOLLO APPLICATIONS  
(PROPOSALS ONLY)



35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.3 TO 0.7 MICRON NA					
33. FIELD OF VIEW		39. GROUND SWATH			
96.0 BY 96.0 DEG 315 NM BY 315 NM FROM 140 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.2 DEG 0.5 NM FROM 140 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		45. INCLINATION	
10.0 DEG 0.2 DEG/SEC LOW CIRCULAR				MEDIUM POSTGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
CAMERA, ELECTRONICS, TAPE RECORDER					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
55 LB		1.6 CU FT		23 WATTS	
51. STANDBY POWER		52. PEAK POWER		53. MTBF	
8 WATTS		8 WATTS		57 WATTS	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. SHIELDING		59. SHIELDING	
53. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
SEE ITEM 31		DELAYED AND REALTIME		CONTINUOUS	
52. TELEMETRY REQUIREMENTS					
REQUIRES 31 ANALOG AND DIGITAL CHANNELS PER WRITE CYCLE FOR HOUSEKEEPING DATA AND 2 CHANNELS FOR SCIENTIFIC DATA: 144-240KHZ FOR VIDEO DATA AND 50 KHZ FOR VIDEO DATA.					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS, FORM 1347, -DAY-NIGHT CAMERA SYSTEM (S039). OCTOBER 30, 1967.					
65. HISTORICAL REMARKS					
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED.					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. VERSION	
DAY/NIGHT CAMERA SYSTEM		DNC		S040		11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
COONEY, T.R.		GODDARD SPACE FLT CENTER		301-982-2606		GODDARD SPACE FLT CENTER		301-982-6563	
12. CONTRACT NUMBER		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. STATUS	
NA		NA		NA		INACT		PLT MODEL	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. VENDOR	
TERWILLIGER, R.G.		NASA HDOTRS		OSSA/SRB		202-962-0574		23. LOCATION	
HAZELTINE CORP.		LITTLE NECK, NEW YORK		NA		24. DATE		25. LEAD TIME	
26. INSTRUMENT TYPE		27. SPACECRAFT		28. APPLICATION		29. PURPOSE		30. PURPOSE	
IMAGER, VISIBLE IMAGE-ORTHICON CAMERA		APOLLO APPLICATIONS						UNC	
PRIMARY-TO PROVIDE DATA TO DEMONSTRATE THE VALUE OF CLOUD COVER IMAGING IN BOTH THE DAY AND NIGHT PORTIONS OF THE EARTH. *** SECONDARY- TO DETERMINE THE EFFECT OF THE NIGHT GLOW BACKGROUND ON CLOUD COVER IMAGING UNDER CONDITIONS OF 'NO MOON'.									
31. PRINCIPLES OF OPERATION									
THIS IMAGE-ORTHICON TV CAMERA SYSTEM IS SIMILAR TO THE ONE ON ATS 4. HERE THERE IS NO STEERABLE MIRROR, AND THE LENS IS AN F/1.8, 9.5 MM FOCAL LENGTH TELEGA THAT GIVES A FOV OF 114.5 DEG. LIGHT FROM THE SCENE TO BE IMAGED PASSES THROUGH A BEAM SPLITTER AND 2 VARIABLE NEUTRAL DENSITY FILTERS. ONE BEAM IS FOCUSED ON A PHOTOMULTIPLIER TUBE, THE OTHER ON THE 0.84 X 0.84 INCH PHOTO-CATHODE OF THE IMAGE-ORTHICON TUBE. THE PHOTOMULTIPLIER OUTPUT CONTROLS THE POSITION OF THE FILTERS WHICH HAVE AN ATTENUATION RANGE OF 1,000,000. ELECTRONIC CONTROLS GIVE ANOTHER FACTOR OF 1,000 IN USEFUL RANGE. THREE PRACTICE FRAMES SET THE LIGHT LEVEL IN THE CAMERA AND GIVE A FINAL PICTURE WITH A BRIGHTNESS RANGE OF 10 LEVELS OF GRAY. EACH FRAME CONTAINS 840 LINES; 800 LINES OF SCENE, AND 40 LINES TO PROVIDE A GRAY SCALE CALIBRATION. FOUR SPECTRAL FILTERS MAY BE PLACED IN THE OPTICAL PATH UPON COMMAND. USABLE PICTURES SHOULD BE OBTAINED UNDER ANY ORBITAL LIGHTING CONDITIONS FROM NOON SUN TO STARLIGHT.									
32. PHENOMENA OBSERVED									
VISIBLE LIGHT REFLECTED FROM THE EARTH AND ITS CLOUD COVER									
33. MEASUREMENT RANGE									
FROM 0.0001 TO 10000 FT-LAMBERT									
34. PRECISION AND ACCURACY									
S/N OF 30 DB FOR MOONLIGHT; S/N OF 20 DB FOR STARLIGHT									

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
DIELECTRIC-TAPE CAMERA		DTC		S040					
(TITLE CONT.)		4. RESUME		5. VERSION					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
BRODERICK, J.		GODDARD SPACE FLT CENTER		301-982-4108					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
NA		NA		NA		NA		STATUS	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. INACT PROTOTYPE	
TERWILLIGER, R.G.		NASA HQTRS		OSSA/SRB		202-962-0574			
22. VENDOR		23. LOCATION		24. FLIGHT DATE		25. LEAD TIME			
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		NA		18 MONTHS			
26. INSTRUMENT TYPE		27. APPLICATION		28. SPACECRAFT		29. UNCLASSIFIED			
IMAGER, VISIBLE SCANNING DIELECTRIC-TAPE CAMERA						UNC			
30. PURPOSE		31. APPLICATIONS		32. SPACECRAFT		33. UNCLASSIFIED			
MET, GEOL, AGRI, CART		APOLLO APPLICATIONS							
<p>PRIMARY-TO DEMONSTRATE THE VALUE OF HIGH-RESOLUTION CLOUD-COVER TELEVISION FOR METEOROLOGY, GEOLOGY, AGRICULTURE, AND CARTOGRAPHY. ***SECONDARY-TO GAIN EXPERIENCE WHICH WILL ASSESS THE USEFULNESS OF THE TAPE CAMERA AS A GENERAL PURPOSE HIGH-RESOLUTION EXPLORATORY DEVICE FOR FUTURE LUNAR OR PLANETARY MISSIONS.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>IN THIS INSTRUMENT A SCANNING MIRROR AND A NARROW ANGLE LENS FOCUS A SCENE IMAGE THROUGH A NARROW SLIT ONTO A DIELECTRIC TAPE. THE SLIT IS ORIENTED WITH ITS LONG AXIS ACROSS THE WIDTH OF THE TAPE. LIGHT REACHES THE TAPE ONLY THROUGH THIS SLIT SO THAT AN IMAGE IS STORED AS THE TAPE MOVES UNDER THE SLIT IN SYNCHRONISM WITH THE SCANNING MIRROR. THE MIRROR SCANS THE EARTH NORMAL TO THE GROUND TRACK, AND A FRAME CONSISTS OF ONE SUCH SCAN. THIS COVERS AN ANGULAR AREA OF 8 DEG BY 50 DEG. UP TO 270 FRAMES PER ORBIT MAY BE STORED ON THE 100 FT OF TAPE IN THE CAMERA. THIS TAPE IS A CRONAR-BASE MATERIAL COATED WITH A THIN INSULATING LAYER AND A PHOTOCONDUCTING LAYER. WHEN A SPOT OF LIGHT STRIKES THE PHOTOCONDUCTOR, CHARGES IN THE INSULATOR AT THIS SPOT LEAK OFF. AN IMAGE THEN IS STORED AS VARIATIONS IN CHARGE ON THE INSULATOR. THE IMAGE STORAGE TIME IS LONG COMPARED TO AN ORBIT PERIOD. THE TAPE IS READ ON COMMAND BY AN ELECTRON BEAM WHICH IS MODULATED BY THE STORED CHARGE ON THE TAPE. A FLOOD GUN IS USED TO ERASE OLD INFORMATION SO THAT THE TAPE MAY BE USED AGAIN AND AGAIN. THE TAPE IS CAPABLE OF STORING IMAGES WITH 17 LINE-PAIRS PER MILLIMETER RESOLUTION.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>SOLAR RADIATION REFLECTED FROM THE EARTH AND CLOUDS</p>									
<p>33. MEASUREMENT RANGE</p> <p>32:1 CONTRAST CAPABILITY REPRODUCED OVER 10 GRAY SCALE STEPS</p>									
<p>34. PRECISION AND ACCURACY</p> <p>SIGNAL TO NOISE RATIO IS 38 DB</p>									

36. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.35 TO 0.7 MICRON NA					
38. FIELD OF VIEW		39. GROUND SWATH			
8.0 BY 50.0 DEG 20 NM BY 130 NM FROM 140 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.02 DEG 300 FT FROM 140 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
10.0 DEG		0.15 DEG/SEC LOW CIRCULAR		MEDIUM POSIGRADE	
46. SPECIAL REQUIREMENTS		47. COMPONENTS		48. INCLINATION	
THE DAY-NIGHT CAMERA SYSTEM (S039) IS USED FOR COMPARISON					
CAMERA ASSEMBLY, ELECTRONICS		50. AVERAGE POWER		51. STANDBY POWER	
83 LB		2.0 CU FT		27 WATT	
54. INTERFERENCE		55. MAGNETIC		56. NUCLEAR	
NONE		NONE		SENSITIVE	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		DELATED TELEMETRY		CONTINUOUS	
62. TELEMETRY REQUIREMENTS		63. ADVANTAGES AND LIMITATIONS		64. REFERENCES	
35 ANALOG CHANNELS FOR TELEMETRY ONCE PER WRITE CYCLE AND ONE VIDEO CHANNEL (680 KC) FOR SCIENTIFIC DATA FOR 6 MINUTES DURING EACH READOUT CYCLE.		HIGH RADIATION RESISTANCE OF THE DIELECTRIC TAPE.			
1) NASA EXPERIMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS-DIELECTRIC TAPE CAMERA (S040). OCT 30, 1967. ***2) APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/MSC, APRIL 1967. ***3) DIELECTRIC TAPE CAMERA. RCA ASTRO-ELECTRONICS DIV.		65. HISTORICAL REMARKS		66. DIAGRAMS	
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM 3. EXT NO								
DUAL-CHANNEL SCANNING IMAGER	DCSI S102								
(TITLE CONT.)	4. RESUME 5. APPROV								
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION								
HOLTER, M.R.	UNIVERSITY OF MICHIGAN								
8. CO-INVESTIGATOR	10. ORGANIZATION								
12. CONTRACT	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. STATUS	17. STATUS	8. TELEPHONE			
NA	NA	NA	NA	NA	NA	INACCT PROPOSAL			
18. MONITOR	19. AGENCY	20. GCM OFFICE	21. TELEPHONE						
TERWILLIGER, R.G.	NASA HDOHRS	QSSA/SRB	202-962-0574						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
NA	NA	NA	18 MONTHS						
26. INSTRUMENT TYPE									
IMAGER, DUAL-CHANNEL IR/VISIBLE SCANNING									
28. APPLICATION									
ERSP, NET									
29. PURPOSE									
APOLLO APPLICATIONS									
30. PRINCIPLES OF OPERATION									
<p>THE PROPOSED INSTRUMENT WILL RECORD IN GRAPHIC FORM THE TERRAIN RADIANCE AS OBSERVED SIMULTANEOUSLY IN 2 SPECTRAL BANDS: A REFLECTIVE CHANNEL, 0.6-0.7 MICRONS; AND AN IR CHANNEL, 10.0-12.5 MICRONS. THE SCANNER WILL HAVE AN INSTANTANEOUS FIELD OF VIEW OF ONE MILLIRADIAN AND A TOTAL SCAN ANGLE OF 80 DEG WHICH WILL GIVE A GROUND RESOLUTION OF APPROX 840 FT FROM A 140 NM ALTITUDE. A SCAN RATE OF 30 LINES PER SECOND WILL PROVIDE CONTIGUOUS SCAN LINES IN THE STRIP MAP. THE SCANNER CONSISTS OF A FLAT, SCANNING 45 DEG MIRROR AND REFLECTIVE IMAGING OPTICS. THE MIRROR SCANS THE TERRAIN BENEATH THE VEHICLE AND ACROSS THE GROUND TRACK. THE RADIATION IS REFLECTED THROUGH THE TELESCOPE AND ONTO A BEAM SPLITTER. ENERGY IN THE 10-12.5 MICRON BAND PASSES THROUGH THE SPLITTER AND IS FOCUSED ONTO A CRYOGENICALLY COOLED THERMAL DETECTOR. WAVELENGTHS LESS THAN 1 MICRON ARE REFLECTED AND PASS THROUGH A FILTER ONTO A PHOTOMULTIPLIER. THE TWO SIGNALS PROCEED TO THE PHOTOREORDER UNIT WHERE THE SIGNALS MODULATE A CRT OR GLOW-TUBE PRINTER FOR DIRECT FILM RECORDING. THE SCANNER ASSEMBLY INCLUDES REFERENCE DEVICES AND OPTICS TO PROVIDE CALIBRATION PULSES DURING THE INACTIVE PORTION OF EACH SCAN.</p>									
32. PHENOMENA OBSERVED									
TERRAIN RADIANCE IN TWO SPECTRAL BANDS, VISIBLE AND IR.									
33. MEASUREMENT RANGE									
16 LEVELS OF GRAY PROVIDE A RANGE OF 4-8 KELVIN DEG AT 320 DEG K									
34. PRECISION AND ACCURACY									
VIS: ACCURACY =0.67 PERCENT; IR: VARIABLE, 4-1 K DEG AT 320 DEG K									

36. SPECTRAL BANDS									
0.6	TO	12.5	MICRONS NA	37. GROUND SWATH					
80.0	BY	0.06 DEG/235 NM	BY 840 FEET FROM 140 NM ALTITUDE						
40. ANGULAR RESOLUTION				41. INCLINATION					
0.06	DEG	840 FEET FROM 140 NM ALTITUDE	42. ALTITUDE						
2.0	DEG	0.4	DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE						
45. SPECIAL REQUIREMENTS									
CRYOGENIC COOLING TO APPROX 28 DEG K REQUIRED FOR IR CHANNEL									
47. COMPONENTS									
SCANNER, COOLANT, RECORDER									
100 LR	3.0	CU FT	60 WATTS	25 WATTS	75 WATTS	48. VOLTAGE			
49. INTERFACING									
SENSITIVE									
50. DATA RECOVERY									
51. FREQUENCY OF OBSERVATION									
52. MANNED RETURN									
53. ADVANTAGES AND LIMITATIONS									
54. REFERENCES									
1) EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS; DUAL-CHANNEL SCANNER-IMAGER (S102). NASA, OCT 30, 67.									
55. HISTORICAL REMARKS									
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED.									
56. DIAGRAMS									

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	ELECTRICALLY-SCANNING MICROWAVE RADIOMETER								
(TITLE CONT.)	ELECTRICALLY-SCANNING MICROWAVE RADIOMETER								
2. ACRONYM	3. EXP NO	ESRR S075							
4. PROJECT NAME	5. VERSION	11/10/69 0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	11/10/69 0005						
THADDEUS, DR. P.	GODDARD INST SPACE STUDY	212-866-3600-X210							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
FERWILLIGER, R.G.	NASA HQ/HQES	OSSA/SRB	202-962-0574						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
SPACE GENERAL CORP.	EL MONTE, CALIFORNIA	NA	18 MONTHS						
26. INSTRUMENT TYPE	RADIOMETER, ELECTRICALLY-SCANNING MICROWAVE								
28. APPLICATION	APOLLO APPLICATIONS								
29. PURPOSE	HET, ATH-PHYS								
PRIMARY-TO MAP THE BRIGHTNESS TEMPERATURE OF THE EARTH AT THE CHOSEN WAVELENGTH ON A GLOBAL SCALE, IN ORDER THAT CORRELATIONS CAN BE MADE BETWEEN THESE MICROWAVE TEMPERATURES AND METEOROLOGICAL OR GEOPHYSICAL PHENOMENA.									
31. PRINCIPLES OF OPERATION									
<p>THE MICROWAVE RADIOMETER IS A SMALL RADIO TELESCOPE DESIGNED TO MAKE MEASUREMENTS (ABSOLUTE ACCURACY TO 1.12 DEG K WITH A STANDARD DEVIATION OF 0.7 DEG K) OF THE INTENSITY OF THERMAL RADIATION AT A WAVELENGTH OF 1.55 CM (A FREQUENCY OF 19.35 GHZ). WITH A 200 MHZ BANDWIDTH, THE RADIOMETER CONSISTS OF A MICROWAVE RECEIVER AND A 2 DIMENSIONAL PHASED ARRAY ANTENNA CONTAINING 49 LINEAR ARRAYS. THE ANTENNA IS DESIGNED TO SCAN ELECTRONICALLY OVER 39 DISCRETE POSITIONS OUT TO 50 DEG ON EACH SIDE OF THE NAIR, IN A LINE PERPENDICULAR TO THE GROUND TRACK OF THE S/C. THE ANGULAR RESOLUTION OF THE ANTENNA IS 2.7 DEG (3 DB POINTS) AT NAIR AND 3 DEG AT THE MAXIMUM SCAN POSITION. THE NOISE TEMPERATURE OF THE ANTENNA IS 1040 DEG K, AND THE SIDE LOBES CONTRIBUTE A MAXIMUM OF 6 PERCENT TO THE SIGNAL. THE INTEGRATION TIME FOR EACH SCAN STEP IS 40 MSEC, AND THE RESULTING SIGNAL IS READ AS A 10 BIT WORD. THE RADIOMETER IS CALIBRATED USING A SKY HORN FOR THE COLD REFERENCE AND AN INTERNAL SOURCE FOR A HOT REFERENCE TEMPERATURE.</p>									
32. PHENOMENA OBSERVED									
INTENSITY AT 1.55 CM (MICROWAVE) OF THERMAL RADIATION FROM EARTH									
33. MEASUREMENT RANGE									
DYNAMIC RANGE = 50 TO 330 DEG K									
34. PRECISION AND ACCURACY									
ABSOLUTE ACCURACY = 1.12 K DEG									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
19.35 GHZ	200. MHZ	
38. FIELD OF VIEW	39. GROUND SWATH	
100. DEG	330 NM DIAM CIRCLE FROM 125 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
2.7 DEG 7 NM FROM 140 NM ALTITUDE		
42. POINTING RATE	43. ALTITUDE	44. INCLINATION
2.0 DEG NA	LOW CIRCULAR	MEDIUM POSIGRADE
45. SPECIAL REQUIREMENTS		
ANTENNA MUST HAVE UNOBSTRUCTED VIEW OF THE EARTH		
46. COMPONENTS		
ANTENNA, ELECTRONICS		
47. WEIGHT	48. VOLUME	49. AVERAGE POWER
30 LB	1.5 CU FT	20 WATTS
50. CAL BRATION	51. SHIELDING	52. DATA RECOVERY
SEE ITEM 31	53. INTERFERENCE	54. INTERFERENCE
10 BIT WORD READ EACH 40 MILLISEC, SERIAL READOUT FOR SIGNAL, AND THREE HOUSEKEEPING SIGNALS	55. DATA RECOVERY	56. DATA RECOVERY
1) NASA EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS-ELEC-SCAN MICROWAVE RADIOMETER (S075), OCT 30, 1967.		
57. HISTORICAL REMARKS		
DUE TO DELAY IN APP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED		
58. DIAGRAM		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. W. NO.	
FILTER-WEDGE SPECTROMETER		FWS		5045		11/10/69		0005	
(TITLE CONT.)									
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
HOVIS, W.A.		GODDARD SPACE FLT CENTER		301-982-6465					
12. CONTRACT		13. CONTRACT NUMBER		14. FLAG INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
NA		NA		NA		NA		INACT PROPOSAL	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. VENDOR	
TERWILLIGER, R.G.		NASA HDQTRS		OSSA/SRB		202-962-0574		23. LOCATION	
24. FLIGHT DATE		25. LEAD TIME		26. INSTRUMENT TYPE		27. STATUS		28. APPLICATION	
NA		18 MONTHS		SPECTROMETER, CIRCULAR-WEDGE-INTERFERENCE-FILTER INFRARED		UNC		29. SPACECRAFT	
30. PURPOSE		APOLLO APPLICATIONS		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE	
PRIMARY - TO INVESTIGATE WITH HIGH RESOLUTION THE IR SPECTRA RECEIVED BY AN INSTRUMENT ABOVE THE ATMOSPHERE AND TO STUDY THE EFFECTS OF ABSORPTION IN THE ATMOSPHERE AND SCATTERING BY DUST PARTICLES. ***SECONDARY - TO EVALUATE THE ABILITY OF THE SPECTROMETER TO DETERMINE GROUND CONDITIONS.									
THIS IR SPECTROMETER CONSISTS OF A TELESCOPE WITH AN F/2 120-MM FOCAL-LENGTH CALCIUM-FLUORIDE LENS, A ROTATING CHOPPER, SYNCHRONOUS MOTORS FOR THE CHOPPER AND FILTER WEDGE, A LEAD SLENDER DETECTOR WITH A LIQUID-NITROGEN COOLING SYSTEM, AND THE FILTER-WEDGE ITSELF. THIS IS A 10-CM (4 INCH) DIAMETER ROTATING INTERFERENCE FILTER THAT, WITH A BLOCKING FILTER, TRANSMITS ONLY A NARROW WAVELENGTH BAND WHOSE CENTER WAVELENGTH VARIES WITH ROTATION ANGLE. HALF THE WEDGE COVERS A SPECTRAL RANGE OF 1.5 TO 6 MICRONS, AND THE OTHER HALF COVERS 8 TO 16 MICRONS. THE RATIO OF PASSBAND TO CENTRAL WAVELENGTH IS EQUAL TO 0.01. A SPECTRAL SCAN (ONE REVOLUTION OF THE WEDGE) TAKES 15 SEC. THE ANGULAR POSITION OF THE WEDGE IS MONITORED AT 2 POINTS DURING EACH ROTATION. THIS DETERMINES WAVELENGTH AS A FUNCTION OF TIME. THE CHOPPER ALTERNATELY EXPOSES THE DETECTOR TO INCOMING RADIATION AND THAT FROM A KNOWN BLACKBODY. AT 4 MICRONS THE SIGNAL TO NOISE RATIO JUST FROM REFLECTED SOLAR ENERGY IS ESTIMATED TO BE 260. THIS RISES SHARPLY AT SHORTER WAVELENGTHS. THE S/N FOR LONGER WAVELENGTHS VARIES WITH THE STATE OF THE ATMOSPHERE AND THE SURFACE IN THE FOV. VERTICAL TEMPERATURE PROFILES AND WATER VAPOR CONTENT CAN BE INFERRED USING INVERSION TECHNIQUES.									
IR RADIATION REFLECTED AND EMITTED FROM THE EARTH'S ATMOSPHERE									
34. PRECISION AND ACCURACY		SIGNAL MEASURED TO ONE PART IN 500							

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
1.5 TO 16.0 MICRONS				50. MICRSEC	
38. FIELD OF VIEW		39. GROUND SWATH			
1.0 BY 3.0 DEG		3.5 NM BY 10.5 NM FROM 200 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
2.0 DEG		0.5 DEG/SEC		LOW CIRCULAR	
45. SPECIAL REQUIREMENTS		46. POSIGRADE			
REQUIRED SUPPORT EXPTS ARE: IRIS, ITPR, AND IR COLOR PHOTOGRAPHY					
47. COMPONENTS		48. OPTICAL SYSTEM, COOLING SYSTEM			
49. WEIGHT		50. VOLUME		51. AVERAGE POWER	
30 LB		1.3 CU FT		7 WATTS	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE	
55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
MEASUREMENT OF BLACK BODY DELAYED TELEMETRY		AS PROGRAMMED			
61. TELEMETRY REQUIREMENTS		62. CHANNEL 1 CONTAINS 130 SPECTRAL ELEMENTS, AND CHANNEL 2 CONTAINS 54. EACH ELEMENT CONTAINS 10 BITS. 15 SEC ARE REQUIRED TO SCAN EACH WHEEL. TOTAL DATA RATE IS 125 BPS. A DATA RUN LASTS 30 MIN.		63. ADVANTAGES AND LIMITATIONS	
64. REFERENCES		1) APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/ MSC, APRIL 1967.			
65. HISTORICAL REMARKS		SIMILAR INSTRUMENT SCHEDULED TO FLY ON NINRUS D.			
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
INFRARED INTERFEROMETER/SPECTROMETER	IRIS		S049						
(TITLE CONT.)	4. RESUME DATE		5. 11 MONTH						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
HANEL, DR. R.A.	GODDARD SPACE FLT CENTER		301-982-4528						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
CONTRACT TYPE	12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. FLASH DATE	15. STATUS					
NA	NA	NA	NA	INACT FLT MODEL					
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	22. DATE					
TERWILLIGER, R.G.	NASA HQDTRS	OSSA/SRB	202-962-0574	NA					
23. VENDOR	24. LOCATION	25. DATE	26. LEAD TIME	27. MONTHS					
TEXAS INSTRUMENTS	DALLAS, TEXAS	NA	21 MONTHS	UNC					
28. INSTRUMENT TYPE									
SPECTROMETER, MICHELSON INTERFEROMETER									
29. APPLICATION	30. SPACECRAFT								
MET, AGEI, GEOL, PLAN-ATH	APOLLO APPLICATIONS								
30. PURPOSE	PRIMARY TO MEASURE TEMP PROFILES, WATER VAPOR DISTRIBUTION, AND OZONE CONCENTRATION; TO DETECT AND MEASURE CH4, N2O, AND OTHER MINOR ATMOSPHERIC CONSTITUENTS; AND TO ANALYZE THE EFFECTS OF CLOUDS AND HAZE ON THE METHODS OF DETERMINATION OF THE ABOVE.***								
31. PRINCIPLES OF OPERATION	THE PROPOSED INSTRUMENT FOR THIS EXPERIMENT IS A TWYMAN-GREEN MODIFICATION OF A MICHELSON INTERFEROMETER/SPECTROMETER. IT IS ESSENTIALLY IDENTICAL TO THE NIMBUS 3 AND D INSTRUMENT EXCEPT FOR A SOLID-NEON COOLED COPPER-DOPED GERMANIUM DETECTOR, SIZED AND POSITIONED TO PROVIDE A 2 DEGREE FIELD OF VIEW. THE INSTRUMENT WILL BE CAPABLE OF 0.07-MICRON RESOLUTION AT THE MEDIAN OF THE SPECTRAL RANGE OF 5.0 TO 22.0 MICRONS. RECEIVED RADIATION IS DIVIDED BY THE BEAMSPLITTER INTO 2 COMPONENTS WHICH RECOMBINE AND INTERFERE AFTER REFLECTIONS ON THE FIXED AND MOVING MIRRORS RESPECTIVELY. THE RECOMBINED BEAM, FOCUSED ON THE DETECTOR, IS MODULATED BY THE MOTION OF THE SCAN MIRROR. THE MODULATION IS PROPORTIONAL TO THE SPEED OF THE MIRROR AND THE WAVE NUMBER OF THE INCIDENT RADIATION. THE OUTPUT SIGNAL FROM THE DETECTOR, CALLED THE INTERPEROGRAM, IS THE FOURIER TRANSFORM OF THE SPECTRUM OF THE INCIDENT RADIATION. AFTER A PREDETERMINED NUMBER OF INTERPEROGRAMS HAVE BEEN RECORDED, TWO CALIBRATION INTERFEROGRAMS ARE OBTAINED, ONE FOR A BLACK BODY AT 300 DEG K AND ONE FOR OUTER SPACE AT NEAR 0 DEG K.								
32. PHENOMENA OBSERVED	THERMAL EMISSION OF THE EARTH'S SURFACE AND ATMOSPHERE								
33. MEASUREMENT RANGE	NEAR 0 TO 300 DEG K								
34. PRECISION AND ACCURACY	ABSOLUTE ACCURACIES OF INTENSITY BETTER THAN 1 PERCENT.								

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
5.0 TO 22.0 MICRONS	0.85 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
2.0 DEG	5 NM DIAM CIRCLE FROM 140 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
2.0 DEG	5 NM FROM 140 NM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
0.5 DEG	0.05 DEG/SEC LOW CIRCULAR	MEDIUM POSIGRADE
45. SPECIAL REQUIREMENTS		
46. COMPONENTS		
SPECTROMETER, ELECTRONICS		
47. WEIGHT	48. VOLUME	49. AVERAGE POWER
58 LB	1.82 CU FT	14 WATTS
50. STANDBY POWER	51. PEAK POWER	52. MTBF
5 WATTS	25 WATTS	
53. SHIELDING	54. INTERFERENCE	55. INTERFERENCE
SENSITIVE THERMAL SHIELD PROVIDED		
56. DATA RECOVERY	57. DELAYED TELEMETRY	58. FREQUENCY OF OBSERVATION
SEE ITEM 31	AS PROGRAMMED	
59. ADVANTAGES AND LIMITATIONS		
3.75 KBS IN 10-BIT WORDS, 1 CHANNEL		
60. REFERENCES		
1) NASA EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS FOR IR INTERFEROMETER SPECTROMETER (S049), OCT 67.***		
2) MINZNER, R.A. ED.: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, NASA/ERC PN-6713, JUNE 1967.		
61. HISTORICAL REMARKS		
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED.		
62. DISCUSSION		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXTEND		4. RESUME		5. EXTEND	
INFRARED TEMPERATURE-PROFILE RADIOMETER (TITLE CONT.)				ITPR		S050			
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. TELEPHONE	
SMITH, DR. W.L.		NAT ENVIRON SAT CTR, BSSA 301-440-7221							
11. CONTRACT NUMBER		12. FLASH INDEX NUMBER		13. DATE		14. STATUS		15. INACT PROTOTYPE	
NA		NA		NA		NA		NA	
16. MONITOR		17. AGENCY		18. PGM OFFICE		19. TELEPHONE		20. LOCATION	
TERWILLIGER, R.G.		NASA HQ/OTRS		OSSA/SRB 202-962-0574					
21. VENDOR		22. LOCATION		23. LEAD TIME		24. LIGHT		25. DATE	
NA		NA		NA		NA		NA	
26. INSTRUMENT TYPE		27. CHANNEL SCANNING FILTER IR		28. APPLICATION		29. SPACECRAFT		30. UNCL	
RADIOMETER, MULTI-CHANNEL SCANNING FILTER IR				APOLLO APPLICATIONS					
31. PURPOSE		32. APPLICATION		33. SPACECRAFT		34. UNCL		35. APPLICATIONS	
NET									
<p>PRIMARY-TO DETERMINE A SIMPLIFIED THREE-DIMENSIONAL TEMPERATURE FIELD OF THE EARTH'S ATMOSPHERE FOR METEOROLOGICAL PURPOSES.*** SECONDARY - TO PROVIDE CONTROLLED TESTING OF THE PERFORMANCE OF THE INSTRUMENT.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS INSTRUMENT IS A MODIFIED VERSION OF THE MEDIUM RESOLUTION SCANNING IR FILTER RADIOMETER PLOWN SUCCESSFULLY ON NIMBUS. THE INSTRUMENT IS DESIGNED TO MEASURE THE IR ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM IN 7 SPECTRAL INTERVALS CENTERED AT 18.6, 14.4, 14.1, 13.8, 13.3, 11.1, AND 3.8 MICRON WITH SPECTRAL BANDPASSES VARYING FROM 0.4 TO 1.0 MICRON. THE INSTRUMENT HAS A TIME CONSTANT OF A FEW MILLISECONDS. A CONSTANT ORIENTATION OF THE INSTRUMENT IS REQUIRED, WITH THE SWATH PASSING SYMMETRICALLY THROUGH OR NEAR THE SUB-SATELLITE POINT. A VIEW OF SPACE IS REQUIRED PERIODICALLY FOR A ZERO REFERENCE. THE RADIOMETER ASSEMBLY CONSISTS OF THE SCANNING MIRROR, PRIMARY OPTICAL ELEMENTS, FILTERS, DETECTORS AND PREAMPLIFIERS. AN ELECTRONICS ASSEMBLY CONTAINS THE INPUT AND MIXER CIRCUITS, SIGNAL DRIVER AMPLIFIERS, SYNCHRONOUS DETECTORS AND OUTPUT FILTERS, ELECTRONICS MODULE POWER SUPPLY, PREAMPLIFIER BIAS SUPPLY, BOLOMETER POWER SUPPLY, AND REFERENCE SIGNAL AND OFF-SET VOLTAGE GENERATOR. RADIOSOURCE DATA CONCURRENT WITH SPACECRAFT ACQUIRED DATA ARE NEEDED TO COMPARE ACTUAL TEMPERATURE PROFILES WITH THOSE DETERMINED FROM THE ITPR DATA USING MATHEMATICAL INVERSION TECHNIQUES.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>INFRARED RADIATION EMITTED BY THE EARTH AND ATMOSPHERE</p>									
<p>33. MEASUREMENT RANGE</p>									
<p>34. PRECISION AND ACCURACY</p>									
<p>S/N WILL BE 100 TO 1 OR BETTER FOR ALL CHANNELS</p>									

11.1 TO 18.6 MICRONS 1.0 MICRON		1.0 MICRON	
6.0 BY 6.0 DEG 12 NM BY 12 NM FROM 120 NM ALTITUDE			
6.0 DEG 12 NM FROM 120 NM ALTITUDE			
1.0 DEG 1.0 DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE			
TEMPERATURE RANGE -15 TO 50 DEG C; NO DIRECT SUNLIGHT IN FOV			
RADIOMETER, ELECTRONICS			
24 LB 0.6 CU FT 15 WATTS NONE 24 WATTS			
10.0 DEG 1.0 DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE			
PERIODIC VIEW OF SPACE DELAYED TELEMETRY AS PROGRAMMED			
DATA RATE IS 10 WORDS PER SECOND: A TOTAL OF 25 CHANNELS IS REQUIRED FOR IR DATA, INTERNAL REFERENCE AND HOUSEKEEPING. THE IR DATA IS SENT IN ANALOG FORM.			
1) NASA EXPERIMENT IMPLEMENTATION PLAN FOR MANNED FLIGHT EXPTS - IR TEMPERATURE PROFILE RADIOMETER (S050). OCTOBER 30, 1967.			
2) NASA EXPERIMENT IMPLEMENTATION PLAN FOR MANNED FLIGHT EXPTS - IR TEMPERATURE PROFILE RADIOMETER (S050). OCTOBER 30, 1967.			
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INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO.		4. RESUME		5. URBAN	
INFRARED TEMPERATURE-SOUNDING EXPERIMENT		IRT		5043					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
SHAW, DR. J.H.		OHIO STATE UNIVERSITY		614-293-7968					
11. CONTRACT NUMBER		12. FLASH INDEX NUMBER		13. START DATE		14. END DATE		15. STATUS	
NA		NA		NA		NA		INACT PROPOSAL	
16. MONITOR		17. AGENCY		18. PCOM OFFICE		19. TELEPHONE			
TERHILLIGER, R.G.		NASA HQ/RTS		OSSA/SRB		202-962-0574			
20. VENDOR		21. LOCATION		22. DATE		23. FLIGHT		24. LEAD TIME	
NA		NA		NA		NA		21 MONTHS	
25. INSTRUMENT TYPE									
SPECTROMETER, IR FIXED-GRATING MULTIDETECTOR RADIOMETER									
26. APPLICATION									
APOLLO APPLICATIONS									
27. PURPOSE									
PRIMARY-TO DETERMINE THE ATMOSPHERIC TEMPERATURE AND WATER VAPOR VERTICAL PROFILES WITH EMPHASIS ON HIGH VERTICAL RESOLUTION. *** SECONDARY-TO DETERMINE THE SURFACE OR CLOUD TOP TEMPERATURES AND PERCENT CLOUD COVER.									
28. PRINCIPLES OF OPERATION									
<p>THE SYSTEM CONSISTS OF A MODIFIED EBERT FIXED GRATING SPECTROMETER PLUS A FILTER RADIOMETER. RADIATION FROM A 12 BY 12 DEGREE FOV ENTERS THE F/3 SYSTEM OF THE SPECTROMETER. A 250-LINE-PER-MM GRATING THAT IS THE LIMITING APERTURE OF THE SYSTEM DISPERSES THE LIGHT TO 15 SEPARATE, LEAD-SELENIDE (PBSE) DETECTORS COOLED TO 193 DEG K. THEY COVER SPECTRAL INTERVALS IN THE REGION 3.5 TO 6.0 MICRONS AND ARE DESIGNED TO GIVE A RESOLUTION OF 1 PERCENT. THE OUTPUT IS USED IN A MATHEMATICAL INVERSION OF THE RADIATIVE TRANSFER EQUATION FOR A VERTICAL TEMPERATURE PROFILE UP TO THE 1 MB LEVEL. A TUNING FORK CHOPPER OPERATING AT ABOUT 300 HZ AT THE ENTRANCE SLIT PROVIDES A TEMPERATURE REFERENCE BY MAINTAINING AND MEASURING THE TEMPERATURE OF THE CHOPPER'S INNER SURFACE TO 0.1 DEG K. THE FILTER RADIOMETER CONTAINS 5 CHANNELS EACH RESPONDING TO 4.6 TO 6.0 MICRON RADIATION TO GIVE CLOUD COVER DATA. HOWEVER, EACH CHANNEL COVERS A DIFFERENT 2.4 BY 2.4 DEGREE PORTION OF THE SPECTROMETER'S 2.4 BY 12 DEG FOV. BY SAMPLING THE RADIOMETER 5 TIMES DURING THE 21.2 SEC INTEGRATION PERIOD OF THE SPECTROMETER AND ALLOWING FOR S/C MOTION, A 25 ELEMENT RADIANCE MAP OF THE SPECTROMETER VIEW IS OBTAINED. AN INTERNAL BLACKBODY PROVIDES PERIODIC CALIBRATION.</p>									
29. PHENOMENA OBSERVED									
REFLECTED AND EMITTED RADIATION FROM THE EARTH AND ATMOSPHERE.									
30. MEASUREMENT RANGE									
DYNAMIC RANGE: 10,000:1 RADIANCE VALUES 200 TO 300 K.									
31. PRECISION AND ACCURACY									
1 PERCENT OF MEASURED RADIANCE VALUE									

32. SPECTRAL RANGE		33. SPECTRAL RESOLUTION		34. T/F CAL CONSTANT	
3.46 TO 6.05 MICRONS		1.0 PERCENT		50. MICRSEC	
35. FIELD OF VIEW		36. GROUND SWATH			
12.0 BY 12.0 DEG 30 NM BY 30 NM FROM 140 NM ALTITUDE					
37. POINTING ACCURACY		38. POINTING RATE		39. ALTITUDE	
2.4 DEG 6 NM FROM 140 NM ALTITUDE				40. ALTITUDE	
1.0 DEG 0.2 DEG/SEC LOW CIRCULAR		41. CIRCULAR		42. POSTGRADE	
43. SPECIAL ATTACHMENTS		44. SPECIAL ATTACHMENTS		45. SPECIAL ATTACHMENTS	
CLEAR FOV OF 12 BY 12 DEGREES, NO WINDOW MATERIAL IS PERMISSIBLE					
46. RADIOMETER HEAD, ELECTRONICS		47. RADIOMETER HEAD, ELECTRONICS		48. RADIOMETER HEAD, ELECTRONICS	
25 LB		1.2 CU FT		50. WATTS	
49. WATTS		50. WATTS		60. WATTS	
51. SENSITIVE		52. SENSITIVE		53. SENSITIVE	
INTERNAL BLACKBODY		DELAYED TELEMETRY		AS PROGRAMMED	
1 DIGITAL CHANNEL, 1000 BPS, 10 BIT WORDS					
54. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
55. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
56. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
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82. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
83. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
84. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
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93. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
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97. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
98. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
99. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					
100. ENGINEERING MODEL BUILT AND SUCCESSFUL BALLOON FLIGHT JULY 1968.					



1. TITLE		2. AGENCY		3. ACQUISITION DATE	
METRIC CAMERA		MCS		15100	
TITLE CONT.		11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE	
SCHMID, DR. H.W.		ESSA-INST FOR EARTH SCI		301-496-8531	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE	
12. CONTRACT NUMBER		13. CONTRACTOR NAME		14. CONTRACT STATUS	
NA		NA		INACT PROPOSAL	
15. MONITOR		16. AGENCY		17. PLUM PRICE	
TERWILLIGER, R.G.		NASA HQTRS		OSSA/SAB 202-962-0574	
22. VENDOR		23. LOCATION		24. DATE	
CARL ZEISS, INC.		444 5TH AVE. N.Y.		18 MONTHS	
26. INSTRUMENT TYPE		27. DATE		28. DATE	
IMAGER, 6-INCH VISIBLE-SPECTRUM METRIC CAMERA, STEREO		29. SPACECRAFT		30. APPLICATION	
RSP, GEOD		APOLLO APPLICATIONS		31. PRINCIPLES OF OPERATION	
<p>THE PHOTOGRAMMETRIC CAMERA WILL BE USED TO OBTAIN STEREO COVERAGE OVER SELECTED SITES. UNIVERSAL-TIME-CORRELATED STAR PHOTOGRAPHY, TAKEN SIMULTANEOUSLY WITH THE GROUND PHOTOGRAPHY, WILL DETERMINE THE ABSOLUTE SPATIAL ORIENTATION OF THE CAMERA. THE FRAME CAMERA WILL OPERATE WITH A FORWARD LAP OF 67 PERCENT. THE SYSTEM CONSISTS OF A 6-INCH FOCAL LENGTH (EFL=152 MM) METRIC CAMERA AND A STELLAR REFERENCE CAMERA, HAVING AN EFFECTIVE FOCAL LENGTH OF 250 TO 300 MM, RIGIDLY CONNECTED IN A POSITION WHICH PLACES ITS OPTICAL AXIS 15 DEG ABOVE THE HORIZON AND 45 DEG FROM THE DIRECTION OF FLIGHT DURING OPERATION. THE PRECISION METRIC LENS WILL BE EITHER OF THE TOPARON OR WIDE ANGLE TYPE, COLOR CORRECTED, WITH A MAXIMUM APERTURE OF AT LEAST F/5.6 AND SUFFICIENT FIELD ANGLE TO COVER THE 23 X 23 CM FORMAT. SYSTEM RESOLUTION OF 40-50 LINES/MM WILL BE OBTAINED WITH THE GROUND IMAGE SCALE BEING 1:1,700,000. CALIBRATION PHOTOGRAPHY, AT THE BEGINNING AND END OF THE OVERALL MISSION, WILL BE OBTAINED BY MANEUVERING THE SPACECRAFT SUCH THAT BOTH CAMERAS CAN PHOTOGRAPH SIMULTANEOUSLY, THE FIELD OF THE FIXED STARS. BOTH CAMERAS WILL BE EQUIPPED WITH FILM CASSETTES, WHICH CAN BE REMOVED BY A GLOVED ASTRONAUT FOR RETURN.</p>					
32. PHENOMENA OBSERVED					
SOLAR RADIATION REFLECTED FROM THE SURFACE OF THE EARTH					
33. MEASUREMENT RANGE					
34. PRECISION AND ACCURACY					
PREDICTED ACCURACY OF GEODETIC CONTROL OF +- 40 METERS					

0.4 TO 0.7 MICRON NA		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
95.0 BY 95.0 DEG 300 MM BY 300 MM FROM 140 NM ALTITUDE		38. GROUND SWATH		39. ALTITUDE	
0.01 DEG 40-50 LINES/MM = 150-200 FEET FROM 140 NM ALTITUDE		40. RESOLUTION		41. INCLINATION	
1.5 DEG 0.05 DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE		42. SCANNING RATE		43. ALTITUDE	
EXPOSURE TIME, S/C TIME, AND UNIVERSAL TIME MUST BE RECORDED		44. SCANNING RATE		45. ALTITUDE	
METRIC CAMERA, STELLAR CAMERA, RECORDING AND CONTROL EQUIPMENT		46. AVERAGE POWER		47. PEAK POWER	
200 LB 12.5 CU FT 250 WATTS NONE		48. AVERAGE POWER		49. PEAK POWER	
SENSITIVE		50. INTERFERENCE		51. SHIELDING	
52. DATA RECOVERY		53. FREQUENCY OF OBSERVATION		54. ADVANTAGES AND LIMITATIONS	
START + END OF SEQUENCE MANNED RETURN AS PROGRAMMED		55. DATA RECOVERY		56. ADVANTAGES AND LIMITATIONS	
UP AND DOWN LINK COMMUNICATION NECESSARY TO UPDATE SITE SELECTION PLAN.		57. DATA RECOVERY		58. ADVANTAGES AND LIMITATIONS	
DATA STORED ON FILM AT S/C MUST BE RETURNED TO EARTH		59. DATA RECOVERY		60. ADVANTAGES AND LIMITATIONS	
1) NASA EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS-METRIC CAMERA (SPECIAL). OCTOBER 30, 1967.		61. DATA RECOVERY		62. ADVANTAGES AND LIMITATIONS	
63. HISTORICAL REMARKS		64. DATA RECOVERY		65. ADVANTAGES AND LIMITATIONS	
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED		66. DATA RECOVERY		67. ADVANTAGES AND LIMITATIONS	
68. DATA RECOVERY		69. DATA RECOVERY		70. ADVANTAGES AND LIMITATIONS	

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE									
MICROWAVE TEMPERATURE-SOUNDING EXPERIMENT									
2. ACRONYM 3. EXP NO									
MTS S104									
4. RESUME									
5. VENDOR									
6. PRINCIPAL INVESTIGATOR									
7. ORGANIZATION									
8. INVESTIGATOR									
9. ORGANIZATION									
10. CONTRACT NUMBER									
11. FLASH INDEX NUMBER									
12. STATUS									
13. CONTRACT NUMBER									
14. FLASH INDEX NUMBER									
15. STATUS									
16. AGENCY									
17. PHONE OFFICE									
18. MONITOR									
19. AGENCY									
20. PHONE OFFICE									
21. TELEPHONE									
22. VENDOR									
23. LOCATION									
24. INSTRUMENT TYPE									
25. INSTRUMENT TYPE									
26. INSTRUMENT TYPE									
27. INSTRUMENT TYPE									
28. APPLICATION									
29. SPACECRAFT									
30. PURPOSE									
31. APPLICATIONS									
32. PURPOSE									
33. APPLICATIONS									
34. PURPOSE									
35. APPLICATIONS									
36. PURPOSE									
37. APPLICATIONS									
38. PURPOSE									
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96. PURPOSE									
97. APPLICATIONS									
98. PURPOSE									
99. APPLICATIONS									
100. PURPOSE									

35. SPECTRAL RANGE	5.5 TO 5.6 MM	36. SPECTRAL RESOLUTION	200. MHZ	37. TIME CONSTANT
38. FIELD OF VIEW	20. DEG	39. GROUND SWATH	50 NM DIAM CIRCLE FROM 140 NM ALTITUDE	
40. ANGULAR RESOLUTION	1.0 DEG	41. SPATIAL RESOLUTION	1.0 DEG	
42. POINTING ACCURACY	NA	43. POINTING RATE	1.0 DEG/SEC	44. ALTITUDE
45. SPECIAL REQUIREMENTS	1.0 DEG	46. CIRCULAR	LOW	47. INCLINATION
48. POSIGRADE	1.0 DEG	49. CIRCULAR	LOW	50. INCLINATION
51. COMPONENTS	2. RADIO METERS WITH COMPONENTS	52. AVERAGE POWER	30 WATT	53. PEAK POWER
54. WEIGHT	50 LB	55. VOLUME	2. CU FT	56. SHIELDING
57. SENSITIVE	58. INTERFERENCE	59. INTERFERENCE	60. INTERFERENCE	61. FREQUENCY OF OBSERVATION
62. TELEMETRY REQUIREMENTS	63. DATA RECOVERY	64. TELEMETRY	65. TELEMETRY	66. TELEMETRY
67. ADVANTAGES AND LIMITATIONS	68. ADVANTAGES AND LIMITATIONS	69. ADVANTAGES AND LIMITATIONS	70. ADVANTAGES AND LIMITATIONS	71. ADVANTAGES AND LIMITATIONS
72. EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS - MICROWAVE TEMPERATURE SOUNDER (S104). NASA, OCT 30, 1967.	73. EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS - MICROWAVE TEMPERATURE SOUNDER (S104). NASA, OCT 30, 1967.	74. EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS - MICROWAVE TEMPERATURE SOUNDER (S104). NASA, OCT 30, 1967.	75. EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS - MICROWAVE TEMPERATURE SOUNDER (S104). NASA, OCT 30, 1967.	76. EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS - MICROWAVE TEMPERATURE SOUNDER (S104). NASA, OCT 30, 1967.

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE <b>MILLIMETER-WAVE PROPAGATION EXPERIMENT</b> (TITLE CONT.)									
2. ACRONYM, S. EXP. NO. MWP 5041									
3. DATE 11/10/69 0003									
6. PRINCIPAL INVESTIGATOR NICHOLS, G.B.									
7. ORGANIZATION SOUTHERN RESEARCH INST									
8. TELEPHONE 205-323-6592-X361									
9. CO-INVESTIGATOR									
10. ORGANIZATION									
11. TELEPHONE									
12. CONTRACT NUMBER NA									
13. FLASH INDEX NUMBER NA									
14. STATUS INACT. PROPOSAL									
15. MONITOR NASA HDOTRS									
16. AGENCY OSSA/SRB 202-962-0574									
17. VENDOR NA									
18. LOCATION NA									
19. LEAD TIME NA									
20. INSTRUMENT TYPE TRANSMITTER, MILLIMETER WAVE 8 PHASE-LOCKED KLYSTRONS									
21. SPACECRAFT APOLLO APPLICATIONS									
22. PURPOSE MET									
23. PRIMARY-TO DETERMINE STATISTICALLY THE ATMOSPHERIC PROPAGATION PARAMETERS THAT ARE IMPORTANT FOR CHARACTERIZING WIDEBAND EARTH-SPACE COMMUNICATIONS PERFORMANCE AT 16 AND 35 GHZ.									
24. PRINCIPLES OF OPERATION ONBOARD THE SPACECRAFT TWO TRANSMITTERS, AT 16 GHZ AND 35 GHZ, WILL TRANSMIT SIGNALS TO RESPECTIVE GROUND STATIONS. BY MEASURING THE AMPLITUDE AND PHASE OF THE RECEIVED SIGNALS MILLIMETER WAVE PROPAGATION CHARACTERISTICS OF THE ATMOSPHERE WILL BE DETERMINED. THE TRANSMITTED SIGNALS ARE PRODUCED BY FOUR 16 GHZ AND FOUR 35 GHZ PHASE-LOCKED KLYSTRONS WHICH ARE SEPARATED IN FREQUENCY BY APPROXIMATELY 450 MHZ. THE ACTUAL OPERATING FREQUENCIES ARE AS FOLLOWS: THE 35 GHZ GROUP INCLUDES 34.457, 34.559, 34.639, AND 34.928 GHZ; THE 16-GHZ GROUP INCLUDES 15.883, 15.984, 16.065, 16.341 GHZ. THE MINIMUM DYNAMIC RANGE OF MEASURABLE ATMOSPHERIC ATTENUATION FOR THE 250 MILLIWATT 35 GHZ DOWNLINK IS 32 DB ASSUMING A RECEIVER NOISE FIGURE OF 12 DB AND A RECEIVER SIGNAL-TO-NOISE RATIO GREATER THAN 10 DB. THE DYNAMIC RANGE OF THE 16 GHZ SYSTEM WILL BE ABOUT 40 DB ASSUMING A 6 DB RECEIVER NOISE FIGURE AND 600 MILLIWATTS OF TRANSMITTED POWER. THE CARRIER SIGNAL AMPLITUDE CAN BE MEASURED TO WITHIN 0.2 DB. THERE IS A PHASE DIFFERENCE BETWEEN CARRIER AND SIDE-BAND OF 7 DEG. THE ATTENUATION IS EXPECTED TO BE FROM 15 DB (HEAVY RAIN AND S/C AT 5 DEG ELEV) TO 0.1 DB (CLEAR WEATHER AND S/C AT ZENITH). THE TRANSMITTED BEAMWIDTH IS 20 DEG.									
25. PHENOMENA OBSERVED MILLIMETER WAVE TRANSMISSIONS FROM SATELLITES									
26. MEASUREMENT RANGE 32 DB FOR 35 GHZ AND 40 DB FOR 16 GHZ									
27. PRECISION AND ACCURACY AMPLITUDE TO PLUS OR MINUS 0.2 DB									

16.0	TO	35.0	GHZ	NA
20.0	DEG 70 NM DIAM CIRCLE FROM 200 NM ALTITUDE			
20.0	DEG 70 NM FROM 200 NM ALTITUDE			
2.0	DEG	0.5	DEG/SEC LOW	CIRCULAR MEDIUM POSTGRADE
ACTIVE COOLING OF TRANSMITTER REQUIRED				
8 KLYSTRON TRANSMITTERS				
200 LB	4.2	CU FT	235 WATTS	270 WATTS
SOURCE/SEN				
OVER GROUND SIGNS REALTIME TELEMETRY AS PROGRAMMED				
NO SCIENTIFIC DATA RECORDED ON-BOARD. TEN CHANNELS OF 8 BITS/WORD, 0.1 SAMPLE/SEC. A 20 DEG BEAMWIDTH SIGNAL IS TO BE USED. EXPERIMENT HOUSEKEEPING DATA ARE REQUIRED.				
ADVANTAGES AND LIMITATIONS				
1) NASA APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/MSC, APR 1967. ***2) MINZNER, R.A. (ED): INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS. NASA/ERC PH-6713, JUNE 8, 1967.				
55. HISTORICAL - NEWARK				
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED				

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
MOLECULAR-OXYGEN MICROWAVE-EMISSION RADIOMETER	MONER	15076							
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
LENOIR, DR. W.B.	MANNED SPACECRAFT CENTER	713-483-2221							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
BARATH, P.T.	JET PROPULSION LAB	213-354-3025							
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PMO OFFICE	21. TELEPHONE						
TERWILLIGER, R.G.	NASA-HQ/OTRS	OSSA/SRB	202-962-0574						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
NA	NA	NA	NA						
26. INSTRUMENT TYPE									
RADIOMETER, 5-CHANNEL MICROWAVE DICKE									
28. APPLICATION	29. SPACECRAFT								
MET. PRSP	APOLLO APPLICATIONS								
30. PURPOSE									
<p>PRIMARY - TO DETERMINE THE TEMPERATURE PROFILE OF THE ATMOSPHERE UP TO A HEIGHT OF 75-80 KM BY MEASURING THE MICROWAVE EMISSION DUE TO MOLECULAR-OXYGEN RESONANCE. WHEN CORRELATED WITH THE RESULTS OF THE WATER-VAPOR-RESONANCE MICROWAVE-EMISSION RADIOMETER EXPERIMENT (AAP, WYMER, S077), TEMPERATURE PROFILES DOWN TO THE EARTH'S SURFACE MAY BE CALCULATED.</p> <p>31. PRINCIPLES OF OPERATION</p> <p>THE INSTRUMENT CONSISTS OF A 5-CHANNEL DICKE RADIOMETER, TWO LOCAL OSCILLATORS AND A 10-INCH PARABOLOID ANTENNA WITH HALF-POWER BEAM WIDTH OF 5-10 DEG. THE INSTRUMENT OPERATES CONTINUOUSLY, VIEWING THE RADIR EXCEPT FOR INFREQUENT CALIBRATION ROLLS (1-4 PER DAY) TO VIEW SPACE. THE INTENSITY OF MICROWAVE RADIATION OR BRIGHTNESS TEMPERATURE IS MEASURED IN FIVE NARROW SPECTRAL BANDS NEAR 60 GHZ (5 MH WAVELENGTH). ONE SPECTRAL BAND IS CENTERED ON A MAGNETICALLY-SPLIT RESONANCE LINE, TWO ARE BETWEEN RESONANCE LINES AND TWO ARE ON THE WINGS OF A STRONG LINE. THESE BANDS RESPOND TO RADIATION MAINLY FROM 3 REGIONS, THE TROPOPAUSE (15-20 KM), THE STRATOPAUSE (45-55 KM) AND THE MESOSPHERE (62-84 KM). THE RADIR BRIGHTNESS TEMPERATURES ARE DERIVED FROM ANTENNA TEMPERATURE MEASUREMENTS THROUGH USE OF THE PRE-MEASURED ANTENNA PATTERN AND THE CALIBRATION DATA. THEN MATHEMATICAL INVERSION TECHNIQUES ARE USED TO INFER AN ATMOSPHERIC TEMPERATURE PROFILE. THE VERTICAL RESOLUTION IS ABOUT 16 KM IN THE MESOSPHERE. THE RADIATION COMES FROM A COLUMN OF AIR WHOSE SURFACE PROJECTION IS 65 KM NORMAL TO THE S/C GROUND-TRACK AND IS EITHER 65 KM OR 130 KM ALONG THE TRACK--DEPENDENT UPON WHETHER THE INTEGRATION TIME IS 10 OR 25 SECONDS.</p> <p>32. PHENOMENA OBSERVED</p> <p>MICROWAVE RADIATION EMITTED FROM THE EARTH'S SURFACE/ATMOSPHERE.</p> <p>33. MEASUREMENT RANGE</p> <p>EXPECTED RANGE OF BRIGHTNESS TEMPERATURE = ZERO TO 400 DEG K</p> <p>34. PRECISION AND ACCURACY</p> <p>BRIGHTNESS TEMPERATURE MEASURED TO WITHIN 2 TO 4 KELVIN DEGREES.</p>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
60.	GHZ	
38. FIELD OF VIEW	39. GROUND SWATH	
4-30.	DEG, SEE ITEM 31	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
4-5.	DEG, SEE ITEM 31	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
2.0 DEG	LOW CIRCULAR	MEDIUM POSIGRADE
45. SPECIAL REQUIREMENTS		
OPERATED IN CONJUNCTION WITH S075 AND S077; SUPPORT PHOTOS REQUIRED		
47. COMPONENTS		
RADIOMETER, 2 LOCAL OSCILLATORS, ONE ANTENNA, AND ELECTRONICS		
48. WEIGHT	49. AVERAGE POWER	50. DUTY CYCLE
30 LB	2.0 CU FT	107 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
SEE ITEM 31	DELATED TELEMETRY	CONTINUOUS
57. TELEMETRY REQUIREMENTS		
FIVE SCIENCE OUTPUTS, EACH SAMPLED TWICE PER SECOND WITH 10 BIT ACCURACY; 10 ENGINEERING OUTPUTS, EACH SAMPLED ONCE EVERY 10 SEC WITH 8 BIT ACCURACY. TOTAL OF 108 BITS/SEC.		
58. ADVANTAGES AND LIMITATIONS		
LIGHT TO MEDIUM CLOUDS WILL NOT AFFECT THE RESULTS AS THEY WOULD FOR IR SOUNDINGS.		
59. REFERENCES		
1) NASA APPLICATIONS A AND B PHASE B STUDY DOCUMENT. NASA/MSC APRIL 1967. ***2) MINZNER, R.A. ED.: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, PH-6713. NASA/ERC, JUNE 1967.		
60. HISTORY OF REVISIONS		
REVISED VERSION OF AN EXPERIMENT (5044B) PROPOSED FOR AAP-A.		
61. DIAGRAMS		

0.27	TO	1.0	MICRONS	1.0	MICRON	36 SPECTRAL RESOLUTION	TIME CONSTANT
74.0	BY	74.0	DEG	188 NM	BY 188 NM	FROM 125 NM	ALTITUDE
0.007	DEG	100 FEET	FROM 125 NM	ALTITUDE			
0.5	DEG	0.03	DEG/SEC	LOW	CIRCULAR	MEDIUM	POSIGRADE
THE LENS SURFACES MUST BE MAINTAINED COMPLETELY CLEAN.							
6. CAMERAS, CALIBRATION DEVICE, CONTROL SYSTEM							
1400 LB	62	CU FT	900 WATTS	1340 WATTS			
SENSITIVE							
GRAY SCALE ON FILM							
MANNED RETURN							
ON COMMAND							
HOUSEKEEPING DATA WILL BE REQUIRED IN THE FORM OF 36 CHANNELS OF 8 BITS/WORD, SAMPLED 6 TIMES PER MINUTE. VOICE CONTACT WITH CREW IS ALSO REQUIRED.							
GREAT AMOUNT OF SPECIFIC DATA AVAILABLE DUE TO SPECTRAL SELECTIVITY CAPABILITIES.							
1) APPLICATIONS B, PHASE B INTEGRATION STUDY DOCUMENT, NASA/MSC APRIL 1967. ***2) PROPOSAL FOR A MULTIBAND SYNOPTIC PHOTOGRAPHIC EXPERIMENT FOR MANNED EARTH ORBITAL MISSIONS, NASA/OSSA, JUNE 10, 1966. ***3) MINZNER, R.A. (ED): INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS, PM-6713. NASA/ERC, JUNE 8, 1967.							
65. HISTORICAL REMARKS							
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED							
66. DIAGRAMS							

MULTIBAND SYNOPTIC PHOTOGRAPHY EXPERIMENT		MBSP S042	
UNIVERSITY OF ARIZONA		602-884-3136	
CO-INVESTIGATOR		TELEPHONE	
UNIVERSITY OF ARIZONA		11/10/69 0003	
CONTRACT NUMBER		NA	
MONITOR		NA	
TECHNICAL INVESTIGATOR		NA	
INSTRUMENT TYPE		NA	
APPLICATION		NA	
PURPOSE		NA	
APOLLO APPLICATIONS			
PRIMARY-TO OBTAIN MULTI-SPECTRAL SYNOPTIC STEREOSCOPIC COVERAGE OVER A SELECTED PORTION OF THE EARTH'S SURFACE FOR THE IDENTIFICATION AND DISCRIMINATION OF SURFACE FEATURES AND CHARACTERISTICS. **SECONDARY-TO PROVIDE DATA FOR CORRELATION WITH DATA OBTAINED BY OTHER REMOTE-SENSOR EXPERIMENTS, SUCH AS IR, RADAR, MICROWAVE, AND UV INSTRUMENTATION.			
THIS SYSTEM CONSISTS OF 5 MATCHED 6-INCH FOCAL LENGTH METRIC CAMERAS (FRAME) AND A SMALLER UV CAMERA BORE-SIGHTED AND SYNCHRONIZED. EACH METRIC CAMERA LENS WILL BE FOCUSED AT INFINITY WITH 74 DEGREES ANGULAR COVERAGE (ACROSS FLAPS) AND FULLY COLOR-CORRECTED OVER A SPECTRAL RANGE OF 4000 TO 10,000 Å. THE EFFECTIVE SHUTTER-SPEED RANGE IS VARIABLE FROM 1/10 TO 1/500 OF A SECOND WITH AN APERTURE CONTROL RANGE FROM F/4.5 TO F/22. FILM FORMAT IS 9 X 9 INCHES. EACH FRAME COVERS A 188 X 188 NM AREA FROM 125 NM ALTITUDE. THE MINIMUM EFFECTIVE RESOLVING POWER OF THE METRIC CAMERAS WILL GIVE A GROUND RESOLUTION OF 30 METERS. THE UV CAMERA (A MAURER) WILL HAVE A QUARTZ/LITHIUM-FLUORIDE LENS WITH A 40 DEG FOV AND WILL USE 70 NM FILM. THE FRAME RATE WILL BE VARIABLE TO PERMIT A MINIMUM OF 10 PER CENT TO A MAXIMUM OF 67 PERCENT OVERLAP ON ADJACENT PHOTOGRAPHS. THE CAMERAS WILL BE FULLY AUTOMATIC AND PRE-PROGRAMMED BUT WILL HAVE PROVISIONS FOR MANUAL OVERRIDE. THREE FILM TYPES WILL BE USED: (1) PAN-CHROMATIC-4000 TO 7000 Å; (2) NEAR INFRARED-7000 TO 10,000 Å; (3) NEAR UV-2700 TO 4000 Å. FILTERS USED WILL BE BROAD BAND (500 Å TO 1500 Å) WITH A SHARP CUTOFF AND HIGH-TRANSMISSION CHARACTERISTICS.			
REFLECTED ENERGY FROM EARTH'S SURFACE AT SPECIFIC WAVELENGTHS			
MEASUREMENT RANGE			
PRECISION AND ACCURACY			
REFLECTED INTENSITY, 5 PCT; REGISTRATION, 0.5 RESOL ELEMENT			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
MULTICHANNEL RADIONETER			MCR		S057				
(TITLE CONT.)			4. RESUME		5. VERSION				
			11/10/69		0003				
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
REA, DR. D. G.	NASA HEADQUARTERS		202-962-5468						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
COMPELL, DR. R.	ONIV OF CALIF., BERKELEY		415-845-6000-X1351						
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER		14. DATE		15. STATUS				
NA	NA		NA		INACT PROPOSAL				
16. MONITOR	17. AGENCY		18. PGM OFFICER		19. TELEPHONE				
CENTERS, C.D.	NASA HQDTRS		LOSSA/SRB		202-962-0574				
22. VENDOR	23. LOCATION		24. LIGHT		25. LEAD TIME				
			NA						
26. INSTRUMENT TYPE									
RADIONETER, 3-CHANNEL TELESCOPIC IR/VISIBLE SCANNING									
27. APPLICATION									
ERSP, HET									
28. PURPOSE									
APOLLO APPLICATIONS									
29. PRIMARY TO PROVIDE INFORMATION ON THE NATURE OF THE EARTH'S SURFACE AND ON PARTICULATE MATTER IN THE ATMOSPHERE.***SECONDARY- TO TEST PRESENT THEORIES OF RAYLEIGH AND MIE SCATTERING.*** TERTIARY-TO MAP CLOUDS, ESTIMATE THEIR HEIGHT, AND GIVE SURFACE THERMAL PROPERTIES DURING BOTH DAY AND NIGHT.									
31. PRINCIPLES OF OPERATION									
<p>THE INSTRUMENT CONSISTS OF A 6-INCH, F/2, CASSEGRAIN TELESCOPE WITH AN IMAGE DISSECTOR IN THE FOCAL PLANE TO DIRECT RADIATION INTO 3 CHANNELS. TUNING FORKS (P=800 HZ) CHOP EACH BEAM. CHANNELS 1 AND 2 MEASURE THE INTENSITY OF REFLECTED SOLAR RADIATION. FILTERS LIMIT CHANNEL 1 TO 6.3 TO 6.5 MICRONS, AND CHANNEL 2 TO 7.9 TO 8.1 MICRONS. THE FILTER FOR CHANNEL 3 PASSES EARTH-EMITTED RADIATION IN THE 10-11 MICRON RANGE. POLAROID DISKS ROTATING AT 111 RPS DETERMINE POLARIZATIONS OF THE BEAMS IN CHANNELS 1 AND 2. AN OSCILLATING MIRROR PLACED IN FRONT OF THE TELESCOPE AT 45 DEG TO THE AXIS SCANS THE SCENE NORMAL TO THE S/C GROUND TRACK. THE SCAN SPEED AND AMPLITUDE ARE CHOSEN SO THAT ADJACENT STRIPS ARE CONTIGUOUS, AND A TWO-DIMENSIONAL IMAGE CAN BE CONSTRUCTED. THE DETECTORS ARE 20-ELEMENT LINEAR ARRAYS, SILICON FOR CHANNELS 1 AND 2 AND THERMISTORS FOR CHANNEL 3. PREFLIGHT CALIBRATIONS FOR THE FIRST TWO CHANNELS ARE USED DURING DATA REDUCTION. A LOOK AT SPACE FOR A ZERO AND AT A HONEYCOMB BLACK-BODY FOR A HIGH TEMPERATURE CALIBRATION ARE TAKEN FOR THE 3RD CHANNEL. INTENSITIES ARE MEASURED TO 0.5 PERCENT OF THE MAXIMUM SIGNAL. A FOUR-STEP AUTOMATIC GAIN CONTROL AVERAGES THE BRIGHTNESS OF A SET OF 200 SCANS AND SETS THE GAIN ACCORDINGLY.</p>									
32. PHENOMENA OBSERVED									
INTENSITY/POLARIZATION OF REFLECTED SOLAR AND EMITTED RADIATION									
33. MEASUREMENT RANGE									
ALBEDO 0 TO 0.85; POLARIZATION 0 TO 0.40; TEMP 200 TO 300 DEG K									
34. PRECISION AND ACCURACY									
ALBEDO AND POLARIZATION WITHIN 0.01; BRIGHTNESS TEMP +/- 1 DEG K									

29. SPECTRAL RANGE	30. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.63 TO 11.0 MICRONS NA		
38. FIELD OF VIEW	39. GROUND SWATH	
8.0 BY 2.3 DEG 28 NM BY 8 NM FROM 200 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.11 DEG 0.4 NM FROM 200 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
0.6 DEG 0.1 DEG/SEC LOW CIRCULAR		
45. SPECIAL REQUIREMENTS	46. INCLINATION	
POSIGRADE		
47. COMPONENTS	48. SPECIAL REQUIREMENTS	
3-CHANNEL RADIONETER, OPTICS, ELECTRONICS		
49. WEIGHT	50. AVERAGE POWER	51. STANDBY POWER
18 LB	0.8 CU FT	14 WATTS
52. INTERFERENCE	53. INTERFERENCE	54. SHIELDING
SENSITIVE TO BE DETERMINED		
55. CALIBRATION	56. DATA RECOVERY	57. FREQUENCY OF OBSERVATION
DELAYED TELEMETRY		
58. TELEMETRY REQUIREMENTS	59. DATA RECOVERY	60. FREQUENCY OF OBSERVATION
AS PROGRAMMED		
TOTAL DATA RATE IS 25.6 KILOBITS PER SECOND		
61. ADVANTAGES AND LIMITATIONS		
THE USE OF AN IMAGE DISSECTOR PERMITS EVERY CHANNEL TO HAVE COMPLETE ACCESS TO THE FULL APERTURE OF THE TELESCOPE.		
62. REFERENCES		
1) NASA APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/MSC, APRIL 1967.***2) REA, D.G.; R. COLWELL, AND K. COULSON: PROPOSAL FOR A 3-CHANNEL RADIONETER FOR THE APOLLO SPACECRAFT. U. OF CALIF., BERKELEY, MAR 66.		
63. HISTORICAL REMARKS		
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT HAS NOT FUNDED.		

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO.		4. RESUME		5. S/N	
MULTISPECTRAL TERRAIN PHOTOGRAPHY EXPERIMENT (TITLE CONT.)		MTP		S101					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. DATE		10. DATE	
SLATER, DR. P.N.		UNIVERSITY OF ARIZONA		602-884-3136		11/10/69		0004	
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. EXPIRY DATE		16. STATUS	
								PROTOTYPE	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. VENDOR	
TERBILGGER, R.G.		NASA HQ/RTS		OSSA/SRB		202-962-0574		18 MONTHS	
24. INSTRUMENT TYPE		23. LOCATION		25. LEAD TIME		26. DATE		27. MONTHS	
HASSELBLAD								UNC	
28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. APOLLO APPLICATIONS			
ERSP, MET									
PRIMARY-TO OBTAIN MULTISPECTRAL COVERAGE OVER A SELECTED PORTION OF THE EARTH'S SURFACE FOR THE IDENTIFICATION AND DISCRIMINATION OF SURFACE FEATURES AND CHARACTERISTICS AND TO OBTAIN PHOTOGRAPHY FOR APPLICATIONS ALREADY DEMONSTRATED.***SECONDARY-TO PROVIDE DATA FOR CORRELATION WITH AN INTERPRETATION OF RESULTS OF OTHER REMOTE SENSORS.									
31. PRINCIPLES OF OPERATION THE SYSTEM CONSISTS OF SIX MATCHED CAMERAS BORESIGHTED AND SYNCHRONIZED TO EACH OTHER AND TO OTHER SENSORS IN THE SPACECRAFT SYSTEM AS REQUIRED BY THE MISSION. THE CAMERAS ARE HASSELBLAD 500 EL (PRIME) CAMERAS WITH 120 MM FOCAL LENGTH LENSES. THE FILM AND FILTERS PROVIDE SPECTRAL DATA FROM ABOUT 0.3 MICRON TO ABOUT 1.0 MICRON. THE FILTERS ARE BROAD BAND (500 A TO 1500 A WIDE) WITH SHARP CUTOFF AND HIGH TRANSMISSION CHARACTERISTICS (GREATER THAN 90 PERCENT AT MAXIMUM TRANSMISSION). FILTERS ARE EITHER OPTICAL PLATS OR PRECISION MENISCUS SHAPES AND ARE PERMANENTLY INSTALLED PRIOR TO FLIGHT TIME. THE SHUTTER IS OF THE INTRA-LENS, HIGH-EFFICIENCY TYPE WITH AN EFFECTIVE SPEED RANGE FROM 1/10 TO 1/500 OF A SECOND. A VARIABLE CYCLING RATE PERMITS A MINIMUM OF 10 PERCENT OVERLAP ON ADJACENT PHOTOGRAPHS. THE SHUTTERS OF THE SIX CAMERAS ARE PROGRAMMED AND SYNCHRONIZED BY A CENTRAL CONTROL SYSTEM. APERTURE CONTROL RANGE IS FROM F/4.5 TO F/22 AND WILL BE CAPABLE OF AUTOMATIC CONTROL. AN IMAGE IS STORED IN A 58 MM BY 58 MM FORMAT ON 70 MM FILM. FILMS TO BE USED INCLUDE PANCHROMATIC (4000 TO 7000 A), NEAR INFRARED (0.7 TO 1 MICRON), COLOR, AND COLOR IR.									
32. PHENOMENA OBSERVED REFLECTED SOLAR RADIATION FROM THE SURFACE OF THE EARTH									
33. MEASUREMENT RANGE ADJUSTS FOR AVERAGE SCENE BRIGHTNESS UP TO A FACTOR OF 1200									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. WAVELENGTH CONSTANT	
0.3 TO 1.0 MICRON		SEP ITEM 31			
38. FIELD OF VIEW		39. GROUND SWATH			
27.0 BY 27.0 DEG		60 NM BY 60 NM FROM 125 NM ALTITUDE			
40. ALTITUDE		41. ALTITUDE			
0.008 DEG/30 METERS (100 FEET) FROM 125 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE			
1.5 DEG		.03 DEG/SEC		LOW CIRCULAR MEDIUM POSIGRADE	
44. SPECIAL REQUIREMENTS		45. SPECIAL REQUIREMENTS			
SVC WINDOW WITH HIGH SPECTRAL TRANSMISSION FROM 0.3 TO 1 MICRON					
46. COMPONENTS		47. COMPONENTS			
6 CAMERAS, 18 MAGAZINES, CONTROLS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
55 LB		1.0 CU FT		NONE	
51. INTERFERENCE		52. INTERFERENCE		53. INTERFERENCE	
NONE		NONE		NONE	
54. CALIBRATION		55. DATA RECOVERY		56. FREQUENCY OF OBSERVATION	
57. PRE- AND POST-FLIGHT		58. PLANNED RETURN		59. COMMAND	
REAL TIME VOICE COMMUNICATIONS ARE DESIRED TO RELAY DATA ON FILM USAGE, TARGET CONDITIONS, WEATHER, AND SO FORTH.					
60. ADVANTAGES AND LIMITATIONS		61. REFERENCES			
62. HISTORICAL REMARKS		63. DIAGRAMS			
THIS EXP IS SIMILAR TO S065 WHICH WAS FLOWN ON APOLLO 9.					
64. REFERENCES		65. ADVANTAGES AND LIMITATIONS			
1) NASA-EXPERIMENT IMPLEMENTATION PLAN FOR MULTISPECTRAL PHOTOGRAPHY/(S101), OCT. 1967.					

<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
<b>RADAR ALTIMETER/SCATTEROMETER</b>	<b>RADAS</b>	<b>SI05</b>							
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
<b>MOORE, DR. R.K.</b>	<b>UNIVERSITY OF KANSAS</b>	<b>913-864-3441</b>							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>INACT PROPOSAL</b>				
18. MONITOR	19. AGENCY	20. POW OFFICE	21. TELEPHONE						
<b>CENTERS, C.D.</b>	<b>NASA HDQTRS</b>	<b>OSSB/SRB</b>	<b>202-962-0574</b>						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>						
26. INSTRUMENT TYPE									
<b>ALTIMETER/SCATTEROMETER, RADAR PULSE SYSTEM FAN BEAM ANTENNA UNC</b>									
28. APPLICATION	29. SPACECRAFT								
<b>OCEAN, GEOL. CART</b>	<b>APOLLO APPLICATIONS</b>								
30. PURPOSE									
PRIMARY-TO PROVIDE RADAR-ALTIMETER-SCATTEROMETER DATA OF THE EARTH FROM ORBITAL ALTITUDES FOR THE STUDY OF EARTH RESOURCES. ***SECONDARY-TO PROVIDE A BASIS FOR THE DESIGN OF SUCCEEDING EARTH ORBITAL RADAR SYSTEMS AND EXPERIMENTS.									
31. PRINCIPLES OF OPERATION	THIS EXPERIMENT USES A COMBINED RADAR-ALTIMETER-SCATTEROMETER, UTILIZING A PULSE SYSTEM, A FAN BEAM ANTENNA, AND SCATTEROMETER GATING OF THE RETURN PULSE. THE FAN BEAM ANTENNA POINTS AHEAD OF OR BEHIND THE SPACECRAFT ALONG THE GROUND TRACK; THE ILLUMINATED AREA ON THE GROUND IS NARROW IN CROSSTRACK DIRECTION, AND EXTENDS FROM THE SUBSATELLITE POINT OUT TO A DISTANCE CORRESPONDING TO AN INCIDENT ANGLE OF 30 DEG. THE INITIAL GROUND RETURN IS USED BOTH FOR ALTIMETRY AND FOR MEASURING SCATTERING COEFFICIENT AT AND NEAR THE VERTICAL. SUBSEQUENT GROUND RETURNS ARE FROM LONGER RANGES AND THEREFORE ARE FROM GROUND PATCHES ILLUMINATED AT DIFFERENT ANGLES OF INCIDENCE. BY SAMPLING THIS RETURN AT SELECTED POINTS, THE RELATION OF SCATTERING COEFFICIENT TO ANGLE CAN BE ESTABLISHED FOR DIFFERENT OF THE CO2 LINES THUS REDUCING THE 712 INV CM CHANNEL WIDTH TO 6.6 INV CM, THE 697 CHANNEL WIDTH TO 2.2 INV CM, THE 675 CHANNEL WIDTH TO 4 INV CM AND A 668 CHANNEL WIDTH TO 1.6 INV CM. THE USE IN OVERLAND EXPERIMENTS A SECOND MODE FOR THE ALTIMETER IS NECESSARY SO THAT IT MAY TRACK THE MORE RAPID VARIATIONS OF THUS THE BANDWIDTH IS NARROWED TO 1.0 INV CM FOR ONE CHANNEL AND 0.83 INV CM FOR THE OTHER. THE DETECTORS ARE THERMISTOR								
32. PHENOMENA OBSERVED									
<b>RETURN OF SPACECRAFT-EMITTED RADAR PULSES</b>									
33. MEASUREMENT RANGE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.4 TO 8.0 GHZ		
38. FIELD OF VIEW	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		LOW CIRCULAR MEDIUM POSIGRADE
45. SPECIAL REQUIREMENTS		
47. COMMENTS		
2. TRANSMITTER/RECEIVERS, 2 ANTENNAS, POWER SUPPLY, CONTROL PANEL		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
		51. STANDBY POWER 52. PEAK POWER 53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. NUCLEAR
		57. THERMAL 58. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
AUTOMATIC AND INTERNAL MANNED RETURN	SPECIFIC AREAS	
62. TELEMETRY REQUIREMENTS		
63. ADVANTAGES AND LIMITATIONS		
64. REFERENCES		
1) NASA EXP. IMPLEMENTATION PLAN FOR A RADAR ALTIMETER/SCATTEROMETER FOR MANNED SPACEFLIGHT. OCT 67.***2) APP A AND B PHASE B INTERGRATION STUDY DOCUMENT. NASA/MSC, APR 67.***3) MOORE, R.K.B AL.: PROPOSAL FOR A RADAR ALTIMETER/SCATTEROMETER TO STUDY THE EARTH'S SURFACE. U KANSAS, 1965.		
65. HISTORICAL REMARKS		
THIS RESUME IS PURPOSELY GENERALIZED DUE TO THE INACTIVE STATUS		
66. DIAGRAMS		



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE <b>RADAR IMAGER</b>									
2. ACQUISITION 3. EXPIRATION DATE <b>RADIM S106</b>									
4. RESUME DATE <b>11/10/69 0005</b>									
5. TELEPHONE									
6. PRINCIPAL INVESTIGATOR <b>MOORE, DR. R.K.</b>									
7. ORGANIZATION <b>UNIVERSITY OF KANSAS</b>									
8. CO-INVESTIGATOR <b>ELDERMEETER, DR. R.D.</b>									
9. ORGANIZATION <b>UNIVERSITY OF KANSAS</b>									
10. CONTRACT NUMBER <b>NA</b>									
11. FLASH INDEX NUMBER <b>NA</b>									
12. STATUS <b>INACT PROPOSAL</b>									
13. AGENCY <b>NA</b>									
14. MONITOR <b>NASA HDQTRS</b>									
15. LOCATION <b>OSSA/SRB 202-962-0574</b>									
16. VENDOR <b>NSR 17-004-003</b>									
17. INSTRUMENT TYPE <b>IMAGER, SIDE-LOOKING RADAR SYNTHETIC APERTURE PHASE COHERENT UNC</b>									
18. APPLICATION <b>ERSP</b>									
19. PURPOSE <b>APOLLO APPLICATIONS</b>									
20. PRIMARY-TO SPACE-QUALIFY THE RADAR IMAGER AT ORBITER ALTITUDES ***SECONDARY-TO PROVIDE INITIAL DATA FOR THE STUDY OF EARTH RESOURCES FROM SPACE. TO PROVIDE A BASIS FOR THE DESIGN OF SUCCEEDING EARTH-ORBITAL RADAR IMAGING EQUIPMENT AND EXPERIMENTS.									
21. PRINCIPLES OF OPERATION A REPRESENTATIVE SIDE-LOOKING RADAR IMAGER CONSISTS OF 2 TRANS- MITTER/RECEIVERS, 2 ANTENNAS, AND ASSOCIATED EQUIPMENT. THE SYSTEM EMITS A CONTINUOUS SERIES OF PULSES OF MICROWAVE FREQUEN- CIES IN THE X BAND (AROUND 3 CM), S BAND (AROUND 15 CM) AND X BAND (AROUND 70 CM). THE SYSTEM WOULD BE COHERENT AND UTILIZE A SYNTHETIC-APERTURE ANTENNA OF THE UNFOCUS- SED TYPE WITH RADIATED BURSTS ILLUMINATING AN AREA OFF TO ONE SIDE OF THE SPACECRAFT'S GROUND TRACK (SIDE-LOOKING) WITH THE ANTENNA RIGIDLY MOUNTED TO THE EXPERIMENT PLATFORM. EACH ANTENNA WOULD CONSIST OF A SLOTTED ARRAY MADE UP OF A NUM- BER OF ELEMENTS, EACH ELEMENTS BEING A PIECE OF RECTANGULAR WAVE GUIDE SLOTTED FOR RECEIVING AND SENDING VERTICAL POLARIZATION IN ONE ANTENNA AND HORIZONTAL POLARIZATION IN THE OTHER. BY STOR- ING SEPARATELY THE REFLECTIONS RECEIVED AT DIFFERENT INTERVALS OF TIME AFTER THE BURST IS INITIATED, THE RETURNS COMING FROM DIFFERENT GROUND DISTANCES OUT TO THE SIDE CAN BE SEPARATED OUT. THE IMAGE SO RECORDED IS NOT DIRECTLY INTERPRETABLE BUT REQUIRES ADDITIONAL GROUND (SYNTHETIC APERTURE) PROCESSING TO PROVIDE A CONTINUOUS STRIP RADAR IMAGE.									
22. PHENOMENA OBSERVED <b>RADAR RETURNS FROM THE EARTH'S SURFACE</b>									
23. MEASUREMENT RANGE									
24. PRECISION AND ACCURACY									

25. OPERATIONAL HISTORY		26. SPECTRAL RESOLUTION		27. TIME CONSTANT	
3.0 TO 70. CM		NA		NA	
28. GROUND SWATH		40 KM			
29. ALTITUDE		150 M			
30. POINTING RATE		45. INCLINATION			
LOW CIRCULAR		MEDIUM		POSIGRADE	
46. SPECIAL REQUIREMENTS					
ANTENNA BEAMS MUST POINT UP 30 DEG IN DIR NORMAL TO S/C MOTION					
47. COMPONENTS					
2. TRANSMITTER/RECEIVERS, 2 ANTENNAS, POWER SUPPLY, FILM RECORDER					
48. WEIGHT 49. VOLUME 50. AVERAGE POWER 51. STANDBY POWER 52. PEAK POWER 53. MTBF					
54. INTERFERENCE 55. INTERFERENCE 56. NUCLEAR 57. INTERFERENCE 58. SHIELDING					
59. CALIBRATION 60. DATA RECOVERY 61. FREQUENCY OF OBSERVATION					
62. TELEMETRY REQUIREMENTS					
FILM RETURN ON COMMAND					
63. ADVANTAGES AND LIMITATIONS					
RADAR HAS ALL-WEATHER CAPABILITIES.					
64. REFERENCES					
1) NASA EXP. IMPLEMENTATION PLAN FOR A RADAR IMAGER SYSTEM FOR MANNED SPACEFLIGHT. OCT 67.***2) APP A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/MSC, APR 67.***3) MOORE, R.K. ET AL: PROPOSAL FOR AN IMAGING RADAR FOR MANNED SPACECRAFT TO STUDY THE EARTH'S SURFACE. U KANSAS, 1966.***4) MOORE, R. ET AL. POTENTIAL RESEARCH AND EARTH RESOURCES STUDIES WITH ORBITING RADAS. AIAA OCT. 1967					
65. HISTORICAL REMARKS					
RESUME IS PURPOSELY GENERALIZED DUE TO INACTIVE STATUS OF INSTR					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. NAME		5. VERSION	
SELECTIVE CHOPPER RADIONETER		SCR		S060		11/10/69		0003	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
HOUGHTON, DR. J. ALSO		OXFORD UNIVERSITY, ENG.				SMITH, DR. D./JOINT PI		READING UNIVERSITY, ENG.	
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. STATUS		15. DATE		16. COMMUNICATION	
NA		NA		INACT		PROPOSAL		NA	
18. MONITOR		19. AGENCY		20. PCM OFFICE		21. TELEPHONE		22. LOCATION	
TERWILLIGER, R.		NASA HDOTRS		OSSA/SAB		202-962-0574		23. LEAD TIME	
26. INSTRUMENT TYPE		27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
RADIONETER, 3 DUAL-CHANNEL IR		UNC		APOLLO APPLICATIONS					
<p>PRIMARY-TO DETERMINE ON A GLOBAL SCALE THE THREE DIMENSIONAL TEMPERATURE STRUCTURE OF THE EARTH'S ATMOSPHERE THROUGH THE USE OF THE 15 MICRON ABSORPTION BAND OF CO<sub>2</sub>.</p>									
<p>EACH OF 6 CHANNELS IS CHOSEN TO SAMPLE THE TEMPERATURE AT A DIFFERENT HEIGHT IN THE ATMOSPHERE. (HIGH WAVE NUMBERS SAMPLE LOWER ALTITUDES.) FROM THIS DATA, USING MATHEMATICAL INVERSION TECHNIQUES, THE VERTICAL TEMPERATURE PROFILE AT 10 KM INTERVALS CAN BE INFERRED. INTERFERENCE FILTERS DETERMINE THE SPECTRUM IN EACH CHANNEL. 3 CHANNELS WITH CENTER WAVE NUMBERS AT 675, 967, AND 712 INV.CM USE FILTERS WITH A HALF BANDWIDTH OF 10 INV. CM (0.22 MIC) THE OTHER 3 CHANNELS ARE CENTERED NEAR 668 INV.CM AND HAVE BANDWIDTHS OF 4 INV.CM (0.087 MIC). TO INCREASE THE SELECTIVITY EVEN MORE THE RADIATION IN EACH CHANNEL IS PASSED THROUGH A CELL CONTAINING CO<sub>2</sub>. FOR THE 3 WIDE BAND AND ONE NARROW BAND CHANNELS THE PASS CAUSES THE ABSORPTION OF THE CENTRAL PORTION OF THE CO<sub>2</sub> LINES THUS REDUCING THE 712 INV.CM CHANNEL WIDTH TO 6.6 INV.CM, THE 697 CHANNEL WIDTH TO 2.2 INV.CM, THE 675 CHANNEL WIDTH TO 4 INV. CM AND A 668 CHANNEL WIDTH TO 1.6 INV.CM. THE OTHER 2 CHANNELS ARE EACH SWITCHED BETWEEN 2 CO<sub>2</sub> CELLS. ONLY RADIATION FROM THE WINGS OF CO<sub>2</sub> ABSORPTION LINES IS CHOPPED; THUS THE BANDWIDTH IS NARROWED TO 1.0 INV.CM FOR ONE CHANNEL AND 0.83 INV.CM FOR THE OTHER. THE DETECTORS ARE THERMISTOR BOLOMETERS SAMPLED ONCE EACH SECOND.</p>									
<p>IR RADIATION EMITTED FROM THE EARTH'S ATMOSPHERE</p>									
<p>200 DEGREES K TO 280 DEGREES K</p>									
<p>0.5 DEG K BELOW 3 NM AND 2 DEG C BETWEEN 10 NM AND 20 NM</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
14.5 TO 15.0 MICRON		5.6 PERCENT		1. MILLISEC	
38. FIELD OF VIEW		39. GROUND SWATH			
10. DEG 35 NM FROM 200 NM ALTITUDE		35 NM DIAM CIRCLE FROM 200 NM ALTITUDE			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
10. DEG 35 NM FROM 200 NM ALTITUDE		VERTICAL-5 NM			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				45. INCLINATION	
46. SPECIAL REQUIREMENTS		LOW CIRCULAR		MEDIUM POSIGRADE	
IR DATA REQUIRED FOR CALCULATIONS OF VERTICAL TEMP PROFILES					
3. RADIONETERS, MIRROR, DETECTOR, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
34 LB		0.5 CU FT		51. STANDBY POWER	
		5 WATTS		52. PEAK POWER	
		1 WATT		53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
ONCE/ORBIT, ZERO AND 88		DELAYED TELEMETRY		CONTINUOUS	
6. ANALOG CHANNELS ARE REQUIRED (8 BITS/WORD, SAMPLED ONCE EACH SECOND).					
63. ADVANTAGES AND LIMITATIONS					
BETTER SPECTRAL RESOLUTION THAN CONVENTIONAL SPECTROMETERS OR INTERFEROMETERS. LIMITED TO ABOVE CLOUDS.					
64. REFERENCES					
1) SMITH, E.W.: SCR SUBSYSTEM DIRECTORY G.E., PHIL. PA. FEB 68.					
***2) MINZNER, R.A.: INTERIM REPORT ON SATELLITE MET INSTRUMENTS NASA/ERC PM-6713, JUNE 1967.***3) GOLDBERG, I.L.: MET IR INSTRUMENTS FOR SATELLITES. PRESENTED AT 13TH ANN TECH SYMP OF SPIE, AUG 1968.***4) APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/HSC, APRIL 1967.					
65. HISTORICAL REMARKS					
SIMILAR INSTRUMENT ON NIMBUS D, ALSO PROPOSED FOR NIMBUS P					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
SHORT-WAVELENGTH SPECTROMETER	SWS		S103						
(TITLE CONT.)	4. RESUME DATE		5. VERSION						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
LOWE, D.S.	UNIVERSITY OF MICHIGAN		313-483-0500-X218						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PMO OFFICE	21. TELEPHONE						
TERWILLIGER, R.G.	NASA HQDTRS	OSSA/SRB	202-962-0574						
22. VENDOR	23. LOCATION		24. LIGHT DATE	25. LEAD TIME					
			NA	18 MONTHS					
26. INSTRUMENT TYPE									
SPECTROMETER, SHORT-WAVELENGTH VISIBLE/NEAR-IR									
28. APPLICATION									
ERSP									
30. PURPOSE									
APOLLO APPLICATIONS									
PRIMARY TO DETERMINE IF SPECTRA OF TERRAIN FEATURES OBTAINED FROM SPACE THROUGH MAJOR ATMOSPHERIC WINDOWS CAN BE CORRELATED WITH GROUND FIELD SPECTRA. ***SECONDARY TO MEASURE THE SCATTERING AND ABSORPTION EFFECTS OF THE INTERVENING ATMOSPHERE.									
31. PRINCIPLES OF OPERATION									
<p>THE INSTRUMENT CONSISTS OF 2 ACCURATELY BORESIGHTED REFLECTING TELESCOPES EACH HAVING AN APERTURE OF 4 IN AND A FOV OF 3 MILLIRADIANS. THIS CORRESPONDS TO A GROUND PROJECTION OF 0.5 NM. HOWEVER, SINCE THE SPACECRAFT WILL TRAVEL 0.42 MI DURING EACH 0.1 SEC SPECTRAL SCAN, THE THEORETICAL MINIMUM TARGET SIZE (UNIFORM, HOMOGENEOUS AREA) IS A 1 NM BY .5 NM RECTANGLE. THE SPECTROMETER WILL COLLECT SPECTRA INTERMITTENTLY OVER A WIDE VARIETY OF TERRAIN FEATURES. EACH SPECTRA WILL CONSIST OF 100 SAMPLINGS, AT A SCAN RATE OF 10 SPECTRA PER SEC. SPECTRA WILL BE RESOLVED BY CIRCULAR VARIABLE FILTERS (CVF) HAVING RESOLVING POWERS OF ABOUT 30. (THE CVF WILL DIVIDE EACH SPECIFIC SPECTRAL REGION INTO 30 PARTS.) THE SHORT WAVELENGTH CVF WILL BE A COMPOUND DEVICE WHEREIN EACH HALF COVERS THE .4-0.75 MICRON AND 0.7-1.35 MICRON REGIONS RESPECTIVELY. THREE DETECTORS WILL BE USED, A PHOTO-MULTIPLIER OR SILICON DETECTOR FOR THE 0.4-0.75 MICRON BAND, AND A GERMANIUM DETECTOR FOR 0.7-1.35 MICRON BAND. A MIRROR CHOPPER WILL BE USED TO TIME SHARE THE BEAM BETWEEN THESE 2 DETECTORS IN SYNCHRONISM WITH THE COMPOUND CVF. A THIRD PBS DETECTOR (PROBABLY COOLED WITH SOLID CO2) WILL BE USED FOR THE 1.3 TO 2.5 MICRON REGION.</p>									
32. PHENOMENA OBSERVED									
REFLECTANCE OF VISIBLE AND NEAR-IR RADIATION FROM TERRAIN									
33. MEASUREMENT RANGE									
EXPECTED VALUES OF .00003 TO .03 WATTS/SQ-CM/STERADIAN/MICRON									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE		36. SPECTRA RESOLUTION		37. CONSTANT	
0.4 TO 2.5 MICRONS					
38. SOUND SIGNAL		39. ALTITUDE		40. ALTITUDE	
0.17 DEG 0.4 NM BY 0.9 NM FROM 140 NM ALTITUDE					
41. POINTING RATE		42. POINTING RATE		43. INCLINATION	
0.37 DEG 0.8 NM FROM 140 NM ALTITUDE (SCAN LIMITED)					
44. SPEC AL REQUIREMENTS		45. SPEC AL REQUIREMENTS		46. SPEC AL REQUIREMENTS	
2.0 DEG 0.40 DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE					
INSTRUMENT MUST BE BORESIGHTED WITH IMAGERS FOR CORRELATION					
SPECTROMETER, COOLANT, RECORDER					
47. COOLANT		48. RECORDER		49. AVERAGE POWER	
50.19 2.0 CU FT		48 WATTS		20 WATTS 65 WATTS	
51. RELEASE		52. RELEASE		53. RELEASE	
54. CALIBRATION		55. DATA RECOVERY		56. DATA RECOVERY	
BY STANDARDIZED LAMPS		DELAYED TELEMETRY		AS PROGRAMMED	
57. HOUSEKEEPING CHANNELS SAMPLED EVERY SECOND FOR A TOTAL OF 40 BITS PER SECOND. TWO DATA CHANNELS EACH PROVIDING 3400 BITS PER SECOND (ANALOG).					
58. ADVANTAGES AND LIMITATIONS					
59. REFERENCES					
1) NASA-EXPERIMENT IMPLEMENTATION PLAN FOR MANNED SPACE FLIGHT EXPERIMENTS-SHORT WAVELENGTH SPECTROMETER (S103), OCT 30, 1967.					
60. HISTORICAL REMARKS					
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED					
61. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
STELLAR REFRACTION DENSITY MEASUREMENT	SRDM	5047							
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
		11/10/69							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
FISCHBACH, DR. F.P.	UNIVERSITY OF MICHIGAN	313-764-6565							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
TERHILLIGER, R.G.	NASA HDOTRS	LOSSA/SRB	202-962-0574						
22. VENDOR	23. LOCATION	24. LIGHT	25. LEAD TIME						
NA	NA	NA	NA						
26. INSTRUMENT TYPE									
STAR-TRACKER, 150-INCH P/15 SCHMIDT-CASSEGRAIN TELESCOPE									
28. APPLICATION	29. SPACECRAFT								
NET									
30. PURPOSE	APOLLO APPLICATIONS								
PRIMARY-TO TEST A TECHNIQUE FOR OBTAINING DETAILED, GLOBAL, ATMOSPHERIC DENSITY PROFILES (AND THUS TEMPERATURE AND PRESSURE PROFILES) BY MEASURING THE REFRACTION ANGLE OF LIGHT FROM STARS WHICH ARE BEING OCCULTED BY THE EARTH. RESULTING PROFILES WILL BE COMPARED WITH THOSE FROM RADIOSONDES. ***SECONDARY-TO OBTAIN INFORMATION ON BACKGROUND RADIANCE NEAR THE HORIZON.									
31. PRINCIPLES OF OPERATION									
THIS EXPERIMENT USES AN AUTOMATIC, GIMBALED, STAR-TRACKING DATA TELESCOPE WITH 150-INCH FOCAL LENGTH, P/15 SCHMIDT CASSEGRAIN OPTICS AND AN ITT F4012 VISSECTOR PHOTOTUBE. THE INSTANTANEOUS FOV IS 30 SEC MOVABLE OVER A 5 MIN FIELD. AN ACQUISITION TELESCOPE, USED TO ACQUIRE THE STAR AND AIM THE DATA TELESCOPE, HAS AN INSTANTANEOUS FOV OF 8 MIN AND IS MOVABLE OVER A 2 DEG FIELD. IN OPERATION AN ASTRONAUT SELECTS AN OCCULTING STAR A FEW DEG ABOVE THE HORIZON. HE MANEUVERS THE S/C SO THAT THE STAR IS IN THE ACQUISITION TRACKER'S FOV. WHEN THE STAR IS TRACKED TO WITHIN AN ARC-MIN OF THE CENTER, CONTROL IS SHIFTED TO THE DATA TELESCOPE WHICH TRACKS TO ITS CENTER WITHIN A FEW ARC-SEC. GYROS MOUNTED ON THE TELESCOPE TUBE ARE UNCAGED AND MEASURE THE TUBE'S MOTION AS THE STAR IS TRACKED. REFRACTION ANGLES INCREASE FROM 0 TO 40 ARC-MIN DURING OCCULTATION WHICH TAKES ABOUT 40 SEC OF TIME. SINCE THE TELESCOPE IS TOO MASSIVE TO FOLLOW EVERY EXCURSION WITH ARC-SEC PRECISION, AN ELECTRONIC OFF-AXIS SIGNAL IS RECORDED AND ADDED TO THE GYRO OUTPUT. THE SUM EQUALS THE INSTANTANEOUS ANGLE OF REFRACTION. AN INVERSION TECHNIQUE GIVES THE INDEX OF REFRACTION AT THE RAY'S TANGENT POINT TO THE EARTH FROM WHICH A DENSITY PROFILE IS DEDUCED.									
32. PHENOMENA OBSERVED									
STELLAR REFRACTION ALONG TWO AXES (ELEVATION AND AZIMUTH)									
33. MEASUREMENT RANGE									
ACQUIRE STARS OF MAGNITUDE 1 TO 5; TRACK THRU RANGE OF 1 TO 8 M									
34. PRECISION AND ACCURACY									
STAR TRACKER ACCURACY IS 2 SEC OF ARC RMS									

35. SPECIAL REQUIREMENTS		36. SPECIAL REQUIREMENTS		37. SPECIAL REQUIREMENTS		38. SPECIAL REQUIREMENTS	
0.95 TO	0.7	MICRON NA	NA	NA	NA	NA	NA
39. FIELD OF VIEW	40. GROUND STATE	41. GROUND STATE	42. GROUND STATE	43. GROUND STATE	44. GROUND STATE	45. GROUND STATE	46. GROUND STATE
SEE ITEM 31	NA	NA	NA	NA	NA	NA	NA
47. GROUND STATE	48. GROUND STATE	49. GROUND STATE	50. GROUND STATE	51. GROUND STATE	52. GROUND STATE	53. GROUND STATE	54. GROUND STATE
0.5 DEG	0.05 DEG/SEC	LOW CIRCULAR	MEDIUM	POSIGRADE			
GYRO DRIFT L 0.05 DEG/HR; OPERATES DURING NIGHT PHASE ONLY							
2. STAR-TRACKING TELESCOPES, 2. GYROSCOPES, MONITORING PANEL							
48. SPECIAL REQUIREMENTS							
110 LB	600 CU FT	85 WATTS	104 WATTS				
49. WEIGHT	50. VOLUME	51. AVERAGE POWER	52. POWER PER A	53. POWER PER A	54. POWER PER A	55. POWER PER A	56. POWER PER A
57. INTERFERENCE	58. INTERFERENCE	59. INTERFERENCE	60. INTERFERENCE	61. INTERFERENCE	62. INTERFERENCE	63. INTERFERENCE	64. INTERFERENCE
65. CALIBRATION	66. DATA RECEIPT	67. DATA RECEIPT	68. DATA RECEIPT	69. DATA RECEIPT	70. DATA RECEIPT	71. DATA RECEIPT	72. DATA RECEIPT
NONE	DELATED TELEMETRY	4 STAR TRACKS/ORB					
1 KILOBIT PER SECOND DURING EACH 40 SECOND OCCULTATION. FOUR OR FIVE OCCULTATIONS DURING EACH ORBIT THE EXPERIMENT IS CONDUCTED.							
S/C MUST MANUEVER TO ACQUIRE EACH STAR, SIMULTANEOUS RADIOSONDE DATA IS REQUIRED. INSTRUMENT REQUIRES 30 MINUTE WARM-UP PERIOD.							
1) APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/ MSC, APRIL 1967. ***2) FISCHBACH, F.P.: MEASUREMENT OF ATMOSPHERIC STRUCTURE BY REFRACTION STAR TRACKING TECHNIQUE, (PROPOSAL). JUNE 1966, U. OF MICHIGAN.							
DUE TO DELAY IN AAP APPROVAL, INSTR. DEVELOPMENT WAS NOT FUNDED							

INSTRUMENT RESUME			
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE	2. AGENCY	3. EXP NO	
UHF-SFERICS DETECTION EXPERIMENT		UHFSD 15048	
(TITLE CONT.)	4. RESUME	5. DATE	
		11/10/69	0003
6. PRINCIPAL INVESTIGATOR	7. ORG. LOCATION	8. TELEPHONE	
ROSSBY, DR. S.A.	NATL CTR FOR ATMOS RES	303-444-5151	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
NELSON, D.F.	AEROSPACE CORP.	213-648-7244	
12. CONTRACT	13. CONTRACT NUMBER	14. CONTRACT DATE	
NA	NA	NA	
15. MONITOR	16. AGENCY	17. INACT. PROPOSAL	
TERHILLIGER, R.G.	NASA HQ/OTRS	OSSA/SRB.202-962-0574	
21. VENDOR	22. LOCATION	23. LEAD TIME	
		NA	
25. INSTRUMENT TYPE	26. APPLICATION	27. SPACECRAFT	
RECEIVER, UHF LOW-NOISE		APOLLO APPLICATIONS	
28. PURPOSE	29. APPLICATION	30. SPACECRAFT	
PRIMARY - TO MEASURE THE FIELD STRENGTH OF UHF SPHERICS. **SECONDARY - TO DETERMINE THE GLOBAL DISTRIBUTION OF THUNDERSTORM ACTIVITY WITHIN THE ORBITAL LIMITATIONS OF THE SPACECRAFT. ***TERTIARY - TO DISTINGUISH, IF POSSIBLE, BETWEEN LIGHTNING AND NON-LIGHTNING ASSOCIATED SPHERICS. NON-LIGHTNING ASSOCIATED SPHERICS MAY BE USED TO INDICATE THE DEVELOPMENT OF INTENSE CONVECTION.			
31. PRINCIPLES OF OPERATION	32. PHENOMENA OBSERVED	33. MEASUREMENT RANGE	
THE INSTRUMENT IS A LOW NOISE UHF RECEIVER TUNED TO 610 MHZ WITH A 2 MHZ BANDWIDTH. THE SPHERICS PULSES (WHICH ARE DETECTED) APPEAR AT THE VIDEO OUTPUT OF A LOGARITHMIC IF AMPLIFIER AND ARE MEASURED BY PULSE-HEIGHT AND WIDTH-DISCRIMINATING ELECTRONICS. THE FRONT END OF THE RECEIVER IS A PARAMETRIC AMPLIFIER FED BY A CAVITY-BACKED PLANAR ARCHMEDEAN-SPIRAL ANTENNA. THE SYSTEM NOISE FIGURE WILL BE LESS THAN 3 DB. THE AMPLITUDE OF THE LARGEST SPHERIC IN EACH 100 MILLISEC SAMPLING INTERVAL WILL BE DIGITIZED TO 6 BITS. PULSE-WIDTH DISCRIMINATING ELECTRONICS DETERMINE WHETHER THE PEAK SPHERIC WAS A SINGLE SHORT PULSE (1-2 MICROSEC) OR WHETHER IT WAS ASSOCIATED WITH A BURST OF PULSES TAKING SEVERAL TENS OF MICROSEC. THE LATTER IS CHARACTERISTICALLY ASSOCIATED WITH LIGHTNING BUT NOT THE FORMER. THE ANTENNA BEAM PROPOSED IS A RIGHT CIRCULAR CONE WITH A HALF-POWER BEAMWIDTH OF 50 DEG. A SCHEME THAT ALLOWS SWITCHING OF BEAMWIDTHS HAS BEEN DEVELOPED AND WILL BE INCORPORATED IF COMPATIBLE WITH THE SPACECRAFT. THIS WOULD PROVIDE A NARROW BEAM, 20-25 DEG, IN ONE MODE (ASTRONAUT PARTICIPATION) AND A BROAD BEAM, 70-80 DEG, (UNMANNED OPERATION) IN THE OTHER MODE.			
33. MEASUREMENT RANGE	34. PRECISION AND ACCURACY	35. ANTENNA GAIN	
RECEIVER HAS A MAXIMUM NOISE OF 3 DB; ANTENNA GAIN IS 6 DB			
36. SIGNAL TO NOISE RATIO	37. SIGNAL TO NOISE RATIO	38. SIGNAL TO NOISE RATIO	
SIGNAL TO NOISE RATIO OF 17.5 TO 27.5 DB			

39. SPECTRAL RESOLUTION	40. TIME CONSTANT
610.	NA
41. FIELD OF VIEW	42. GROUND SWATH
NA	NA
43. ITEM 31	44. SPATIAL RESOLUTION
SEE ITEM 31	NA
45. ITEM 31	46. POINTING RATE
NA	NA
47. ALTITUDE	48. INCLINATION
2.0 DEG	LOW CIRCULAR MEDIUM POSIGRADE
49. SPECIAL REQUIREMENTS	50. SIMULTANEOUS REFERENCE PHOTOGRAPHY
UHF RECEIVER, ANTENNA SYSTEM, SIGNAL-PROCESSING UNIT	
51. WEIGHT	52. VOLUME
33 LB	0.9 CU FT
53. WATTS	54. WATTS
5	6
55. AVERAGE POWER	56. STANDBY POWER
57. INTERFERENCE	58. SHIELDING
59. DATA RECOVERY	60. FREQUENCY OF OBSERVATION
61. ADVANCES AND LIMITATIONS	62. REFERENCES
1 BUFFERED DIGITIZER OUTPUT CONTAINING 8 AND 10 BIT WORDS PER EVENT AND 50 BITS/SEC FOR NOISE-PULSE DATA. 8-BIT WORDS SAMPLED ONCE EVERY 50 MS. 10-BIT WORDS ONCE EVERY 100 MS. TOTAL= 310 BPS	
A HIGHER INCLINATION WOULD PROVIDE MORE CLASSES OF THUNDERSTORMS FOR STUDY: LOWER ALTITUDES WOULD PROVIDE STRONGER SPHERICS	
1) APPLICATIONS A AND B PHASE B INTEGRATION STUDY DOCUMENT. NASA/ MSC, APRIL 1967. **2) ROSSBY, S.A. AND NELSON, D.A.: MEASUREMENT OF SPHERICS FIELD STRENGTH FROM A SATELLITE. SEPT. 1966. ***3) NASA EXPERIMENT IMPLEMENTATION PLAN FOR UHF SPHERICS DETECTION (5048). OCTOBER 30, 1967.	
63. HISTORICAL REMARKS	64. DIAGRAMS
DUE TO DELAY IN AAP APPROVAL, INSTR DEVELOPMENT WAS NOT FUNDED.	

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THIS INSTRUMENT WAS ALSO PROPOSED FOR NIMBUS PA

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM, S. EXP. NO.		3. ACRONYM, S. EXP. NO.		4. RESULT		5. DATE	
WATER-VAPOR-RESONANCE MICROWAVE RADIOMETER				WVRMR		5077			
(TITLE CONT.)									
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. TELEPHONE	
STAPLIN, DR. D.H.		MASS INSTITUTE OF TECH		617-864-6900X3711					
11. CONTRACT NUMBER		12. CONTRACT NUMBER		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE	
NA		NA		NA		213-354-3025		11/10/69 0003	
16. MONITOR		17. AGENCY		18. HOW OF FICE		19. AGENCY		20. HOW OF FICE	
TERHILLIGER, R.G.		NASA HDOTPS		OSSA/SRB		202-962-0574		21. LEAD TIME	
22. VENDOR		23. LOCATION		24. DATE		25. DATE		26. DATE	
27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE		31. PRINCIPLES OF OPERATION	
RADIOMETER, 5-CHANNEL MECHANICALLY-SCANNING DICKE MICROWAVE UNC		MET. ERSP		APOLLO APPLICATIONS					
<p>PRIMARY-TO-MEASURE AND MAP THE THERMAL MICROWAVE EMISSION FROM THE TERRESTRIAL SURFACE AND ATMOSPHERE NEAR THE 1.35 CM WATER VAPOR RESONANCE, AND THEREBY OBTAIN INFORMATION CONCERNING THE VARIATION OF THE ATMOSPHERIC WATER VAPOR ABUNDANCE AND DISTRIBUTION WITH ALTITUDE, LIQUID WATER CONTENT OF THE ATMOSPHERE, SURFACE BRIGHTNESS TEMPERATURES, AND SEA STATE.</p> <p>THE WATER-VAPOR RESONANCE MICROWAVE RADIOMETER CONSISTS OF A MECHANICALLY-SCANNING 5-CHANNEL DICKE MICROWAVE RADIOMETER AND ANTENNAS (2 OF THE CHANNELS SHARE AN ANTENNA). THE CHANNEL FREQUENCIES ARE 10, 19, 22.2, 32 AND 52.8 GHZ. THE ANTENNAS 14 CM. WITH BEAMWIDTHS OF APPROXIMATELY 5 DEG. THE ANTENNAS SCAN THE EARTH'S SURFACE NORMAL TO THE S/C GROUND TRACK OUT TO 60 DEG ON EACH SIDE. IN THE GROUND TRACK-SPACECRAFT PLANE THE ANTENNAS POINT EITHER 50 DEG AHEAD OR BEHIND THE NADIR. A SCAN PERIOD (120 DEG AND BACK) TAKES 40 SEC WITH AN INTEGRATION TIME OF 1 SEC FOR EACH INSTANTANEOUS POV. THIS POV IS 50 BY 100 KM; HOWEVER, THE S/C MOTION DURING THE INTEGRATION TIME SHEARS THIS TO 100 BY 100 KM. THE RADIATION INTENSITY IS INFERRED FROM THE MEASURED ANTENNA TEMPERATURES USING ONE MINUTE CALIBRATION SEQUENCES EVERY 10 MIN AND BY ROLLING THE S/C TO LOOK AT COLD SPACE FOR A MINIMUM OF 10 MIN EVERY 6 HR. THE DESIRED ATMOSPHERIC AND SURFACE PARAMETERS ARE OBTAINED FROM THE 5 INTENSITY MEASUREMENTS BY STATISTICAL PARAMETER-ESTIMATION TECHNIQUES.</p>									
32. PHENOMENA OBSERVED									
MICROWAVE RADIATION EMITTED FROM THE EARTH'S SURFACE/ATMOSPHERE									
33. MEASUREMENT RANGE									
BRIGHTNESS TEMPERATURE FROM ZERO TO 400 DEGREES KELVIN									
34. PRECISION AND ACCURACY									
SENSITIVITY IS ABOUT 0.3 TO 1.5 DEG K FOR 1 SEC INTEGRATION TIME									

0.57	TO	3.0	CM	0.33	PERCENT
120.	BY	5.0	DEG 700 NM BY 50 NM FROM 200 NM ALTITUDE		
14.0	DEG 50 NM (WITH SMEAS) FROM 200 NM ALTITUDE				
2.0	DEG	0.5	DEG/SEC LOW CIRCULAR MEDIUM POSIGRADE		
5	DICKE-TYPE RADIOMETERS, 4 ANTENNAS, ELECTRONICS				
80 LB	13.0	CU FT	180 WATTS	244 WATTS	
SPE ITEM 31	DELATED TELEMETRY	CONTINUOUS			
5	SCIENCE OUTPUTS, EACH SAMPLED TWICE PER SECOND WITH 10 BIT ACCURACY; 10 ENGINEERING OUTPUTS, EACH SAMPLED ONCE EVERY 10 SECONDS WITH 8 BIT ACCURACY. TOTAL IS 108 BITS/SEC.				
1	LIGHT-TO-MED CLOUDS WILL NOT AFFECT THE RESULTS AS MUCH AS THEY WOULD FOR IR SOUNDINGS; VERY HEAVY CLOUDS AND RAIN WILL DEGRADE				
1	NASA APPLICATIONS A AND B PHASE INTEGRATION STUDY DOCUMENT. NASA/NSC, APRIL 1967.***2) MINZNER, R.A.ED.: INTERIM REPORT ON SATELLITE METEOROLOGICAL INSTRUMENTS. NASA/SRC PH-6713, JUNE 1967.				
55	HISTORICAL REMARKS				
1	ORIGINALLY S04MA. PART OF INTEGRATED PASSIVE MICROWAVE EXPT.				
166	DIAGRAMS				

NIMBUS D  
(PROPOSALS ONLY)



INSTRUMENT RESUME				
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS				
1. TITLE	2. ACRONYM	3. EXP NO		
CLOUD-TOP ALTITUDE RADIONETER	CAR			
(TITLE CONT.)	4. RESUME DATE	5. WHEN		
	11/10/69	0006		
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE		
WARK, DR. D.O.	NAT ENV SAT CTR ESSA	301-440-7114		
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE		
SALEDY, DR. F.	UNIVERSITY OF MARYLAND	301-735-0021		
12. TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. STATUS
NA	NA	NA	NA	INACT PROPOSAL
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	
SCHARDT, B. B.	NASA HDOTRS	QSSA/SRN	202-962-0891	
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME	
NA	NA	NA	NA	
26. INSTRUMENT TYPE	27. SINGLE GRATING	28. LITROW TYPE		
SPECTROMETER			UNC	
29. APPLICATION	30. SPACECRAFT			
HEX	NIMBUS D			
31. PURPOSE				
PRIMARY-TO DETERMINE CLOUD TOP ALTITUDE TO AN ACCURACY OF A FEW HUNDRED METERS.**SECONDARY-TO ESTIMATE THE THICKNESS OF CLOUDS AND THEIR LIQUID WATER CONTENT.				
31. PRINCIPLES OF OPERATION	<p>THE INSTRUMENT PROPOSED FOR THIS EXPERIMENT IS A SINGLE GRATING LITROW SPECTROMETER WHICH MEASURES, SIMULTANEOUSLY, RADIANCES IN 3 NARROW, SPECTRAL REGIONS: 2 REGIONS ARE IN THE OXYGEN "A" BAND AT 0.76 MICRON, AND ONE IS JUST OUTSIDE THE BAND. THIS REGION, CENTERED AT 7578 A, SERVES AS A REFERENCE SIGNAL. THE 2 REGIONS IN THE BAND, ONE CENTERED AT 7606 A, THE OTHER CENTERED AT 7631 A GIVE CLOUD-TOP HEIGHT INFORMATION FOR HIGH ALTITUDE CLOUDS AND LOW TO MEDIUM ALTITUDE CLOUDS RESPECTIVELY. BY RECORDING SOLAR AND VIEWING ANGLE MEASURING THE ATTENUATION DUE TO MOLECULAR OXYGEN IN THE AIR FOR THE LIGHT REFLECTED FROM THE CLOUD TOP, THEN KNOWING THE DEPENDENCE OF THIS ATTENUATION ON PATH LENGTH AND ANGLE OF VIEW THE CLOUD-TOP HEIGHT IS DEDUCED. THE CENTER OF EACH WAVELENGTH REGION IS SET TO WITHIN 1 A OF THE NOMINAL VALUE, AND THE BANDPASS OF EACH REGION AT HALF-MAXIMUM TRANSMISSION IS 8.0 A TO WITHIN 0.5 A. THE INSTRUMENT SCANS SPATIALLY ACROSS THE SUBSATELLITE TRACK OUT 22.5 DEG ON EACH SIDE OF THE NADIR IN 80 DISCRETE STEPS. THE RADIANCE IN EACH OF THE THREE WAVELENGTH REGIONS IS DIGITIZED AS A 10 BIT NUMBER STORED IN THE S/C RECORDER. CALIBRATION IS PERFORMED WHEN NEEDED BY VIEWING THE SUN USING A DIFFUSE REFLECTOR.</p>			
32. PHENOMENA OBSERVED				
RELATIVE INTENSITY OF REFLECTED SOLAR RADIATION FROM CLOUDS				
33. MEASUREMENT RANGE				
INTENSITY RANGES 2.4 TO 240 ERG/SEC/SQ-CM/STERADIAN/MICRON				
34. PRECISION AND ACCURACY				
CLOUD HEIGHT WITHIN 200 M; ABSOLUTE ALBEDO: 3% AT FULL SCALE				

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
7578.0 TO 7631.0 A	0.1 PERCENT	1.0 MILLISEC
38. FIELD OF VIEW	39. GROUND SWATH	
45.0	DEG 250 NM DIAM CIRCLE FROM 600 NM ALTITUDE	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.5 DEG	DEG 6.3 NM AT THE CENTER FROM 600 NM ALTITUDE	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
0.5 DEG		45. INC. NA IN
46. SPECIAL REQUIREMENTS	MED CIRCULAR SUN-SYNCH RETROGRADE	
47. COMPONENTS		
SPECTROMETER, ELECTRONICS		
48. WEIGHT	49. AVERAGE POWER	50. DUTY CYCLE
23 LB	7.4 CU FT	7 WATTS
51. HEIGHT	52. HEIGHT	53. HEIGHT
7.4 CU FT	7 WATTS	13 WATTS
54. AVERAGE POWER	55. DUTY CYCLE	56. SHIELDING
7 WATTS	13 WATTS	
57. CALIBRATION	58. DATA RECOVERY	59. AGENCY OF OBSERVATION
SEE ITEM 31	DELATED TELEMETRY	DAYLIGHT ONLY
60. ADVANTAGES AND LIMITATIONS		
3 PRIMARY CHANNELS SAMPLED WITH 10 BIT RESOLUTION 80 TIMES IN 1 SEC FOR A PEAK BIT RATE OF 2.4 K BITS/SEC. THE 0.6 SEC RETRACE RESULTS IN REDUCTION OF EFFECTIVE BIT RATE TO 1.8 K BITS/SEC.		
INVERSION TECHNIQUES NOT NEEDED; CORRECTION FOR ABSORPTION IN CLOUD NEEDED. COVERAGE GAP FOR ADJACENT ORBITS 1000NM AT EQUATOR		
1) SALEDY, F. ET AL.: CLOUD TOP ALTITUDE MEASUREMENT FROM SATELITES. APPLIED OPTICS, VOL. 4 1965.***2) MINZNER, R. A.: INTERIM REPT ON SATELLITE NET INSTRUMENTS. NASA/ERC PS-6713, JUN 1957.***3) WARK, D.O. AND MERCER, D.M.: ABSORPTION IN THE ATMOSPHERE BY THE OXYGEN-A-BAND. APPLIED OPTICS, VOL 4, 1965.***4) PROPOSAL FOR A CLOUD-TOP ALTITUDE RADIONETER FOR NIMBUS D. ESSA, JAN 1966.		
65. HISTORICAL REMARKS		
THIS INSTRUMENT DID NOT RECEIVE FINAL APPROVAL FOR FLIGHT.		
66. DIAGRAMS		

NIMBUS E  
(PROPOSALS ONLY)

<b>BIOGRAPHIC RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
<b>1. TITLE</b> AERONOMY EXPERIMENT (TITLE CONT.)			
<b>2. PRINCIPAL INVESTIGATOR</b> LAUSON, J.		<b>3. EX NO.</b> APRON E09	
<b>4. ORGANIZATION</b> MASSACHUSETTS INST TECH		<b>5. PHONE</b> 619-864-6900	
<b>6. CONTRACT NUMBER</b> DR. R. MASSACHUSETTS INST TECH		<b>7. DATE</b> 11/10/69 0006	
<b>8. FLASH INDEX NUMBER</b> NA		<b>9. DATE</b> NA	
<b>10. AGENCY</b> NASA HQTRS		<b>11. TELEPHONE</b> 202-962-0891	
<b>12. VENDOR</b> SCHARDT, B. B.		<b>13. LOCATION</b> OSSA/SRN	
<b>14. INSTRUMENT TYPE</b> SPECTROMETER, LIMB-SCANNING PHOTOMETRIC		<b>15. SPACECRAFT</b> PRO	
<b>16. APPLICATION</b> MET, ATM-PHYS		<b>17. PURPOSE</b> PRIMARY-TO MEASURE THE VERTICAL DISTRIBUTION OF DENSITY, TEMPERATURE, AND CERTAIN TRACE CONSTITUENTS, ON A GLOBAL SCALE *** SECONDARY-TO TEST A TANGENTIAL-VIEWING SATELLITE EXPERIMENT FOR DETERMINING ATMOSPHERIC PROCESSES ABOVE 25 KILOMETERS.	
<b>31. PRINCIPLES OF OPERATION</b> THE ATMOSPHERE IS TO BE SCANNED ACROSS THE LIMB OF THE EARTH WITH A PHOTOMETER HAVING A NARROW FIELD OF VIEW. THE SYSTEM CONSISTS OF A REFLECTIVE LENS TO COLLECT ENERGY AND FOCUS IT ON A SLIT APERTURE, A SET OF IMAGE DISSECTING MIRRORS AND BEHIND EACH MIRROR, A FILTER AND SENSOR FOR THE ASSOCIATED WAVELENGTH. THE FILTER MIRRORS ARE SELECTED AND PLACED SUCH THAT EACH PASSES A DIFFERENT NARROW WAVELENGTH BAND TO A PHOTODIODE OR OTHER DETECTOR AND REFLECTS THE REMAINING WAVELENGTHS ONTO THE NEXT FILTER MIRROR. THE WAVELENGTHS TO BE MEASURED ARE 2600-4000 A, 5770 A, AND 6 AND 15 MICRONS. USING SATELLITE ATTITUDE INFORMATION, HORIZON AND SUN SENSORS WILL BE USED TO DETERMINE THE ATTITUDE OF THE PHOTOMETER RELATIVE TO THE HORIZON. SCANNING IN ALTITUDE IS ACCOMPLISHED BY PITCHING THE OPTICAL SYSTEM. A STAR OCCULTOMETER WILL ALSO BE USED TO PROVIDE INFORMATION ON ABSORBING AND SCATTERING ATMOSPHERIC COMPONENTS, SUCH AS AIR AND OZONE, DURING THE NIGHTSIDES OF THE ORBITS. THE SYSTEM TRACKS A STAR LOCATED NEAR THE ORBITAL PLANE AND MEASURES ITS INTENSITY AS IT MOVES INTO OR OUT OF THE ATMOSPHERE DUE TO VEHICLE ORBITAL MOTION. PHOTOMETRIC INSTRUMENTS PRODUCE A SIGNAL WHICH IS PROPORTIONAL TO THE INCIDENT RADIATION INTENSITY.			
<b>32. PHENOMENA OBSERVED</b> SOLAR AND STELLAR UV ENERGY PASSING THROUGH THE ATMOSPHERE			
<b>33. MEASUREMENT RANGE</b> INTENSITIES OF 0.1 PICOWATTS TO 0.1 MILLIWATTS			
<b>34. PRECISION AND ACCURACY</b> MAXIMUM NOISE ESTIMATED TO BE 2 PERCENT OF MAXIMUM INTENSITY			

<b>35. SPECTRAL RESOLUTION</b> 0.26 TO 15.0 MICRONS		<b>37. TIME CONSTANT</b> 0.1 SECOND	
<b>36. GROUND SWATH</b> 0.04 BY 4.6 DEG 1 KM BY 111 KM FROM 250 KM ALTITUDE		<b>38. ALTITUDE</b> 0.04 DEG 1 KM FROM 250 KM ALTITUDE	
<b>39. POINTING RATE</b> 0.02 DEG		<b>40. INCLINATION</b> HIGH	
<b>41. SPECIAL REQUIREMENTS</b> WILL REQUIRE ON-BOARD COMPUTER TO PROGRAM EXPERIMENT			
<b>42. COMPONENTS</b> 43. WEIGHT 44. VOLUME 45. AVERAGE POWER 46. STANDBY POWER 47. PEAK POWER 48. MTBF 49. MECHANICAL 50. ELECTRICAL 51. INTERFERENCE 52. SHIELDING 53. TELEMETRY REQUIREMENTS 54. DATA RECOVERY 55. FREQUENCY OF OBSERVATION			
<b>56. PRIOR TO MEASUREMENT</b> PRIOR TO MEASUREMENT DELAYED TELEMETRY WHENEVER POSSIBLE			
<b>57. ADVANTAGES AND LIMITATIONS</b> VERY ACCURATE ATTITUDE CONTROL REQUIRED, PITCHES ENTIRE S/C FOR VERTICAL SCAN MODE, REQUIRES ON-BOARD COMPUTER.			
<b>58. REFERENCES</b> 1) LAUSON, J. AND NEWELL, R.: PROPOSAL FOR A MIT AERONOMY EXPERIMENT, E-2220, FEB 68. ***2) LAUSON, J.: DATA ACQUISITION AND REDUCTION MIT X-15 HORIZON DEFINITION EXPERIMENT PHASE 2, MIT INSTRUMENTATION LAB, DEC 66.			
<b>59. HISTORICAL REMARKS</b>			
<b>60. DIAGRAMS</b>			

INSTRUMENT RESUME			
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE	2. ACRONYM	3. EXP NO.	
AIR POLLUTION SURVEY EXPERIMENT	APSRV	E21	
(TITLE CONT.)	4. RESUME DATE	5. FUNDING	
	11/10/69	0004	
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	
GORSCHBOTH, DR. P.P.	IBM FEDERAL SYSTEMS DIV.	301-657-2900	
9. CO INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
BARRINGER, DR. A.E.	BARRINGER RESEARCH LTD.	416-677-2491	
12. CONTRACT	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. STATUS
NA	NA	NA	INACT PROPOSAL
16. MONITOR	17. AGENCY	18. PGM OFFICE	19. TELEPHONE
SCHARDT, B. B.	NASA HDOTRS	OSSA/SRN	202-962-0891
20. VENDOR	21. LOCATION	22. FLIGHT	23. LEAD TIME
BARRINGER RESEARCH	REXDALE, TORONTO, CANADA	NA	
24. INSTRUMENT TYPE	25. INSTRUMENT TYPE	26. INSTRUMENT TYPE	27. INSTRUMENT TYPE
SPECTROMETER, ULTRAVIOLET CROSS-CORRELATING GRATING OR PRISM			
28. APPLICATION	29. SPACECRAFT	30. PURPOSE	
NET. ERSR		NIMBUS E	
31. PRINCIPLES OF OPERATION			
<p>PRIMARY-TO DEVELOP THE CAPABILITY OF OBTAINING GLOBAL ATMOSPHERIC POLLUTION DATA.***SECONDARY-TO DETERMINE THE DEGREE TO WHICH NATURAL UV RADIATION REFLECTED FROM EARTH CAN BE DETECTED AT SATELLITE ALTITUDES. TO IDENTIFY SULFUR DIOXIDE AND NITROUS DIOXIDE VAPOROUS POLLUTANTS AND TO DETERMINE MASS TRANSPORT MECHANISMS OF POLLUTANTS.</p> <p>THE AIR POLLUTION SURVEY SYSTEM WILL BE USED TO INVESTIGATE THE CONCENTRATION AND DISTRIBUTION OF SELECTED VAPOROUS POLLUTANTS. TWO CORRELATING SPECTROMETERS, EACH INVESTIGATING A SINGLE ATMOSPHERIC POLLUTANT - INDUSTRIAL DISCHARGE(SO2) AND AUTOMOBILE EXHAUST(NO2) - WILL BE USED. THE DESIGN IS BASED ON THE BARRINGER/AISI REMOTE SENSING SULFUR DIOXIDE MONITOR. THE SPECTROMETER OPTICS HAVE AN INSTANTANEOUS FIELD OF VIEW OF ONE DEGREE WHICH IS SHEPT THROUGH PLUS AND MINUS 15 DEGREES NORMAL TO THE LINE OF FLIGHT. THE ABSORPTION SPECTRUM OF INCOMING RADIATION IS OPTICALLY CROSS-CORRELATED AGAINST A STORED REPLICA OF THE SPECTRUM OF THE GAS TO BE DETECTED, AND PROVIDES AN ELECTRICAL OUTPUT DIRECTLY RELATED TO THE INTEGRAL DENSITY OF THE GAS ALONG THE VIEWING PATH. THIS TECHNIQUE OF CORRELATION SPECTROMETRY MEASURES THE INTEGRAL OF POLLUTION DENSITY OVER THE ENTIRE DISTANCE THAT LIGHT TRAVELS FROM THE SUN TO THE GROUND AND BACK TO THE SATELLITE. FOR THIS REASON SATELLITE MEASUREMENTS WOULD BE SUPERIOR TO GROUND MEASUREMENTS FOR DETERMINING TOTAL ATMOSPHERIC POLLUTANT BURDEN OR TOTAL POLLUTANT TRANSPORT ACROSS A BOUNDARY.</p>			
32. PHENOMENA OBSERVED	UV RADIATION REFLECTED FROM THE EARTH'S SURFACE		
33. MEASUREMENT RANGE	20 TO 2000 PPM/METER FOR BOTH SO2 AND NO2		
34. PRECISION AND ACCURACY	+50 PERCENT AT 20 PPM/METER; +10 PERCENT AT 2000 PPM/METER		

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
2800.	0.23 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
30. BY 1.0 DEC/322 NM BY 10 NM FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
1.0 DEC/10 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
45. SPECIAL REQUIREMENTS	46. SPECIAL REQUIREMENTS	47. SPECIAL REQUIREMENTS
48. CORRELATION SPECTROMETERS, FORROPTICS, SCANNING MIRROR SYSTEM	49. AVERAGE POWER	50. STANDBY POWER
	15 WATTS NONE	18 WATTS
51. WEIGHT	52. VOLUME	53. MTBF
30 LB	1.0 CU FT	
54. INTERFERENCE	55. INTERFERENCE	56. SHIELDING
57. DATA RECOVERY	58. DATA RECOVERY	59. FREQUENCY OF OBSERVATION
NONE	DELATED TELEMETRY	SPECIFIC AREAS
60. ADVANTAGES AND LIMITATIONS	METHOD OF PRODUCING SPECTRUM MASK PRODUCES A REPLICA WHICH CONTAINS ALL ABERRATIONS OF THE SPECTROMETER. OZONE MAY BE PROBLEM	
61. REFERENCES	1) GORSCHBOTH, F. AND BARRINGER, A.: PROPOSAL FOR AN AIR POLLUTION EXPERIMENT, IBM CORP, FEB 68.***2) BARRINGER, A.: AIRBORNE MEASUREMENTS OF ATMOSPHERIC SULPHUR DIOXIDE OVER WASHINGTON, DC, 1967.	
62. HISTORICAL REMARKS		



<b>INSTRUMENT RESUME</b> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
ATMOSPHERIC DENSITY BY STELLAR REFRACTION		SRDM		B11					
(TITLE CONT.)		4. RESUME		5. 11/10/69					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
FISCHBACH, P.P.		U OF MICHIGAN		313-764-5565					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
BARTMAN, F.		U OF MICHIGAN		313-764-7210					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. START DATE		15. STATUS			
NA		NA		11/10/69		PROPOSAL			
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE			
SCHARDT, B.		NASA HQDTRS		OSSA/SRN 202-962-0891		22. LEAD TIME			
22. VENDOR		23. LOCATION		24. DATE		25. MONTHS			
U OF MICHIGAN		ANN ARBOR, MICHIGAN		NA		31 MONTHS			
26. INSTRUMENT TYPE		27. APPLICATION		28. SPACECRAFT		29. SIGNATURE			
STAR TRACKER, DOUBLE TELESCOPE IMAGE-DISSECTING PHOTOTUBE		UNC		NIMBUS B					
30. PURPOSE									
PRIMARY-TO MEASURE THE VERTICAL PROFILES OF ATMOSPHERIC DENSITY, PRESSURE AND TEMPERATURE FOR COMPARISON WITH CONVENTIONAL MEASUREMENTS AND MEASUREMENTS OVER SPARSE DATA AREAS**SECONDARY-TO GATHER NIGHTTIME CLOUD-TOP-HEIGHTS STATISTICS, DATA ON BACKGROUND RADIANCE NEAR THE HORIZON, AND STARLIGHT ATMOSPHERIC ATTENUATION.									
31. PRINCIPLES OF OPERATION THE EXPERIMENT PROPOSES TO MEASURE THE REFRACTION OF STARLIGHT PASSING THROUGH THE ATMOSPHERE AT DIFFERENT ALTITUDES TO GIVE A VERTICAL DENSITY PROFILE. THE AMOUNT THAT LIGHT IS REFRACTED IS PROPORTIONAL TO THE DENSITY OF THE ATMOSPHERE. FROM THE DENSITY, THE PRESSURE AND TEMPERATURE CAN BE INFERRED. THE INSTRUMENT PROPOSED IS AN AUTOMATIC STAR-TRACKER, CONSISTING OF A DOUBLE TELESCOPE ASSEMBLY (SECTIONS A AND B) AND AN IMAGE-DISSECTING PHOTOTUBE. THE GIMBALED TELESCOPE ASSEMBLY VIEWS THE HORIZON IN THE ORBITAL PLANE. UPON COMMAND THE TRACKER SCANS ACROSS 60 DEGREES IN AZIMUTH AND 8 DEGREES IN ELEVATION SEEKING A STAR. IT IS TRACKED BY A PRE-SET BRIGHTNESS. UPON FINDING SUCH A STAR, IT IS TRACKED BY A SECOND TELESCOPE WITH A FIELD OF VIEW OF 17 ARC-MIN BY 17 ARC-MIN, UNTIL OCCULTATION BY THE EARTH. THE APPARENT ANGULAR DISPLACEMENT, WHICH IS A MEASURE OF THE REFRACTIVITY, IS THEN RECORDED. AFTER OCCULTATION THE PROCESS IS REPEATED. THE PERIOD OF TIME FOR ACQUISITION IS 5 TO 10 SECONDS, DEPENDING ON LOCATION OF BRIGHT STARS. TRACKING UNTIL OCCULTATION REQUIRES ONE TO THREE MINUTES DEPENDING UPON ELEVATION OF INITIAL ACQUISITION.									
32. PHENOMENA OBSERVED									
STARLIGHT PASSING THRU ATMOSPHERE									
33. MEASUREMENT RANGE									
DENSITY PROFILES BETWEEN EXTANT CLOUD TOPS AND 30 KM									
34. PRECISION AND ACCURACY									
I TO 4 ARC-SEC RMS									

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
0.3 TO 0.9 MICRONS! NA					
39. FIELD OF VIEW		40. GROUND SWATH			
0.28 BY 0.28 DEG NA					
41. ANGULAR RESOLUTION		42. SPATIAL RESOLUTION			
43. POINTING RATE		44. ALTITUDE		45. INCLINATION	
ANY		SUN-SYNCH		RETROGRADE	
46. SPECIAL REQUIREMENTS					
STELLARITE POSITION TO WITHIN ACCURACY OF THE TRACKING NETWORK					
47. COMPONENTS					
2. TELESCOPES/GYROSCOPES, IMAGE DISSECTOR PHOTOTUBE					
48. WEIGHT					
44 LBS					
49. VOLUME					
3.74 CU FT					
50. AVERAGE POWER					
5 WATTS					
51. PEAK POWER					
35 WATTS					
52. INTERFERENCE					
53. INTERFERENCE					
54. SHIELDING					
55. CALIBRATION					
160. DATA RECOVERY					
56. FREQUENCY OF OBSERVATION					
NONE					
57. TELEMETRY REQUIREMENTS					
58. TELEMETRY REQUIREMENTS					
59. DURING NIGHTTIME					
TOTAL BITS/DATA POINT=11 DIGITAL FOR SECTION B, AND 39 DIGITAL FOR SECTION A (10 SAMPLES/SECOND OR 390 DPS DIGITAL)					
60. ADVANTAGES AND LIMITATIONS					
CONTINUOUS WORLDWIDE MEASUREMENTS, LIMITED TO NIGHTTIME OPERATION AND ABOVE CLOUDS					
61. REFERENCES					
1) FISCHBACH, P.P.: PROPOSAL FOR STELLAR OCCULTATION-REFRACTION MEASUREMENTS, UNIV OF MICHIGAN, FEB 68.**2) FISCHBACH, P.P.: A SATELLITE METHOD FOR PRESSURE AND TEMPERATURE BELOW 24 KM, BULLETIN AMER MET SOCIETY, VOL 46 NO 9, SEPT 1965.					
62. HISTORICAL REMARKS					
63. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO.							
ATMOSPHERIC OZONE EXPERIMENT	ATOZ	E16							
(TITLE CONT.)	4. RESUME	5. DATE							
		11/10/69	0005						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
PALMER, C. E.	UNIV CALIFORNIA AT L. A.	213-272-8911							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
DUARDO, J. A.	ELECTRO-OPTICAL SYSTEMS	213-681-4671							
12. CONTRACT	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START	16. DURATION	17. STATUS				
NA	NA	NA	NA	INACT	PROPOSAL				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HDQTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
ELECTRO-OPTICAL SYSTEMS	PASADENA, CALIFORNIA	NA	32 MONTHS						
26. INSTRUMENT TYPE									
SPECTROMETER, ULTRAVIOLET FIXED-GRATING POLYCHROMATOR									
28. APPLICATION	29. SPACECRAFT								
NET. ATM-PHYS	NINBUS E								
30. PURPOSE									
<p>PRIMARY-TO MEASURE ATMOSPHERIC OZONE BY MONITORING THE ATTENUATED SOLAR RADIATION IN THE MIDDLE UV AS THE SUN IS OCCULTED BY THE EARTH AND ITS ATMOSPHERE. THIS DATA IS IMPORTANT FOR THE ANALYSIS OF THE BUILDUP AND COLLAPSE OF THE POLAR STRATOSPHERIC VORTICES**SECONDARY-TO ACQUIRE DATA FOR ONE YEAR OVER BOTH POLAR CAPS TO BE THE BASE OF A NEW OZONE CLIMATOLOGY IN HIGH LATITUDES</p> <p>THE SPECTROMETER WILL MONITOR THE ATTENUATED SOLAR RADIATION IN THE MIDDLE UV AS THE SUN IS OCCULTED BY THE EARTH AND ITS ATMOSPHERE. TEN DIFFERENT WAVELENGTHS (EACH OF 2.5 A BANDWIDTH) WILL BE ISOLATED BY THE SPECTROMETER. 2600, 2750, 2850, 2950, 3050, 3150, 3250, 3350, 3450, AND 3800 A. ALTHOUGH 9 WAVELENGTHS NEED TO BE MONITORED DURING ONE OCCULTATION ONLY 3 WAVELENGTHS WILL BE MONITORED AT ANY INSTANT. THE WAVELENGTHS WERE CHOSEN TO COMPLEMENT ONE ANOTHER, AS EACH WAVELENGTH GIVES INFORMATION IN ONLY ONE ALTITUDE RANGE. IN ADDITION, THE MONITORING OF 3800A WILL DETECT POSSIBLE ATTENUATION DUE TO AEROSOL AND DUST LAYERS OVER THE ENTIRE ALTITUDE RANGE FROM 50 TO 70 KM. A MEASUREMENT OF SOLAR INTENSITY MUST BE MADE AT A GIVEN WAVELENGTH WHEN THE SATELLITE IS IN AN UNOCCULTED POSITION TO CALIBRATE THE TOTAL INSTRUMENT RESPONSE FOR THE SOLAR IRRADIANCE AT THE GIVEN WAVELENGTH. A SIMILAR MEASUREMENT AT ANY POINT IN THE OCCULTED PORTION OF THE ORBIT THEN PROVIDES A TRANSMISSION MEASUREMENT FOR THE CORRESPONDING ATMOSPHERIC PATH. THE SATELLITE, DUE TO ITS ORBITAL MOTION, ACTUALLY VIEWS THE SUN THROUGH A CONTINUOUS NUMBER OF ATMOSPHERIC PATHS. AN OPTICAL IMAGE SLICING TECHNIQUE, REDUCING THE SUN TO A THIN HORIZONTAL LINE SOURCE, IS TO BE EMPLOYED.</p> <p>32. PHENOMENA OBSERVED</p> <p>ULTRAVIOLET SOLAR ENERGY ATTENUATED BY THE EARTH'S ATMOSPHERE</p> <p>33. MEASUREMENT RANGE</p> <p>OZONE PROFILES FROM 20-70 KM, FROM 60 TO 85 DEG N AND S LATITUDE</p> <p>34. PRECISION AND ACCURACY</p> <p>ALTITUDE WITHIN 5 KM; S/N=1000 FOR 2600 A WITH 1 INCH COLLECTOR</p>									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
2600. TO 3800. A	0.208 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
0.03 DEG NA	DEG NA	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.03 DEG NA		
42. POINTING RESOLUTION	43. POINTING RATE	44. ALTITUDE
		MED
45. INCLINATION	SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS	TIME AND DURATION OF OCCULTATION MUST BE PRECISELY KNOWN	
47. COMPONENTS	SPECTROMETER, ELECTRONICS	
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
16 LB.	7 CU FT	9 WATTS
51. STANDBY POWER	52. PEAK POWER	53. MTBF
	0 WATTS	12 WATTS
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. DATA RECOVERY	58. DATA RECOVERY	59. FREQUENCY OF OBSERVATION
ONCE EVERY ORBIT	DELAYED TELEMETRY	TWICE PER ORBIT
60. TELEMETRY REQUIREMENTS		
PRODUCES OUTPUT DURING A 36 SECOND INTERVAL, TWICE PER ORBIT. REQUIREMENT IS FOUR 10-BIT DIGITAL WORDS SAMPLED AT 1 SECOND INTERVALS FOR TOTAL OF 40 BITS/SECOND DURING 36 SECOND INTERVAL.		
ADVANTAGES AND LIMITATIONS		
OCCULTATION TECHNIQUE HAS UNIQUE ADVANTAGES IN TRACING HIGH ALTITUDE OZONE; ACCURATE POINTING REQUIRED.		
REFERENCES		
<p>1) PALMER, C., ET AL: PROPOSAL FOR INVESTIGATION OF OZONE MEASUREMENTS IN THE TERRESTRIAL ATMOSPHERE, UCLA, JAN 68.</p> <p>***2) PITTOCK, A., J.G.R., V. 68, P. 5143 (1963). ***3) LIBBY, W.P., J.G.R., V. 65, P. 3307, (1960).</p>		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

INSTRUMENT RESUME			
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE	2. ACRONYM	3. EXP NO	
BACKSCATTERED ULTRAVIOLET RADIATION EXPERIMENT	BUY	B15	
(TITLE CONT.)	4. RESUME DATE	5. 14-00000	
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	
HEATH, DR. D. F.	GODDARD SPACE FLT CENTER	301-982-6421	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
MATEER, DR. C. L.	NAT CNTR ATMOSPHERE RES	303-444-5151	
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. STATUS	
NA	NA	INACT: PROPOSAL	
15. MONITOR	16. AGENCY	17. DATE	
SCHARDT, B. B.	NASA HQDTRS	OSSA/SRN 202-962-0891	
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME
		NA	
26. INSTRUMENT TYPE	27. SPACECRAFT	28. APPLICATION	29. PRO
SPECTROMETER, TWO EBERT-PASTIE PHOTOMETRIC			
30. PURPOSE	31. NIMBUS E		
PRIMARY TO PROVIDE SYSTEMATIC GLOBAL SCALE OBSERVATIONS OF THE SPATIAL DISTRIBUTION OF ATMOSPHERIC OZONE BY INVERSION OF MEASUREMENTS OF ULTRAVIOLET RADIATION BACKSCATTERED BY THE ATMOSPHERE.			
31. PRINCIPLES OF OPERATION			
<p>THE PURPOSE OF THE EXPERIMENT IS ACCOMPLISHED BY INVERSION OF MEASUREMENTS OF SOLAR UV RADIATION BACKSCATTERED BY THE ATMOSPHERE AT 12 DIFFERENT WAVELENGTHS WITH A 10 ANGSTROM BANDPASS IN THE SPECTRAL REGION 2555-3398A. THE BACKSCATTERED RADIATION WILL BE MEASURED IN THE NADIR DIRECTION WHEN THE SATELLITE IS ON THE DAYLIGHT SIDE OF THE EARTH TO PROVIDE CALIBRATION. THE DIRECT SOLAR RADIATION WILL BE MEASURED, BY USING A DIFFUSER PLATE TO REFLECT THE RADIATION INTO THE INSTRUMENT, AS THE SATELLITE ENTERS THE DARK ZONE. DETECTION OF THE RADIATION BACKSCATTERED IN THE 3125-3398 A SPECTRAL RANGE DURING NIGHTS OF FULL MOON WILL BE USED TO DEDUCE NIGHT TIME OZONE. AN INDEPENDENT DIFFUSER-PLATE MEASUREMENT OF DIRECT MOONLIGHT WILL BE ACCOMPLISHED AS THE SATELLITE EXITS FROM THE DARK ZONE. THE INSTRUMENT BASICALLY CONSISTS OF A DOUBLE (TANDEM) EBERT-FASTIE SPECTROPHOTOMETER WITH A 12-DEGREE FIELD OF VIEW AND A SLIT-WIDTH OF 10 ANGSTROMS, AND AN ANCILLARY NARROW-BAND INTERFERENCE FILTER PHOTOMETER. THE PHOTOMETER WILL BE ATTACHED TO THE INSTRUMENT TO MEASURE THE REFLECTIVITY OF THE GROUND-ATMOSPHERE SYSTEM IN THE SPECTRAL REGION FREE OF OZONE ABSORPTION. THE INSTRUMENT WILL RECORD A 50 A BAND CENTERED AT 3800 A.</p>			
32. PHENOMENA OBSERVED			
BACKSCATTERED UV SOLAR RADIATION FROM ATMOSPHERE & LUNAR SURFACE.			
33. MEASUREMENT RANGE			
HEIGHTS GREATER THAN 30 KILOMETERS			
34. PRECISION AND ACCURACY			
0.2 ANGSTROM			

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
2555 TO 3800 A	0.0161 PERCENT	
38. FIELD OF VIEW	39. GROUND SWATH	
12 DEG NA		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		RED
45. SPECIAL REQUIREMENTS	46. INCLINATION	
	SUN-SYNCH RETROGRADE	
47. COMPONENTS		
SPECTROPHOTOMETER, FILTER PHOTOMETER, ELECTRONICS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
35 LB	75 CU FT	14 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
		20 WATTS
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
	DELAYED OR REALTIME	CONTINUOUS
57. TELEMETRY REQUIREMENTS		
FOUR 10 BIT WORDS WILL BE REQUIRED FOR EACH 2.5 SEC READOUT OF ONE OF THE 12 WAVELENGTHS MEASURED		
58. ADVANTAGES AND LIMITATIONS		
SATELLITE METHODS MOST PRACTICAL FOR OBTAINING CONTINUOUS HIGH ALTITUDE OZONE MEASUREMENTS.		
59. REFERENCES		
<p>1) HEATH D.F. AND MATEER, C.L.: PROPOSAL TO DETERMINE THE SPATIAL DISTRIBUTION OF ATMOSPHERIC OZONE FROM MEASUREMENTS OF UV RADIATION BACKSCATTERED BY THE EARTH'S ATMOSPHERE USING NIMBUS E, GSPC, FEB 68.***2) DAVE, J.V. AND MATEER, C.L., INTER SYM ON ELECTRO-MAG SENSING OF EARTH FROM SATELLITES, POLYTECHNIC PRESS, N.Y., NOV 65.</p>		
60. HISTORICAL REMARKS		
61. DIAGRAMS		



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. FILE NO.	
GLOBAL RADAR FOR OCEAN WAVES AND WINDS (TITLE CONT.)		GRWC		F14					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. DATE		10. DATE	
PIERSON, DR. W.J.		NEW YORK UNIVERSITY		212-584-0700-526					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE		12. CONTRACT NUMBER		13. START DATE	
MOORE, DR. R. K.		UNIVERSITY OF KANSAS		913-UN4-3441					
12. TYPE		13. FLASH INDEX NUMBER		14. DATE		15. STATUS		16. DATE	
NA		NA		NA		INACT PROPOSAL			
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. LEAD TIME	
SCHARDT, B. B.		NASA HQDTRS		OSSA/SRN		202-962-0891			
22. VENDOR		23. LOCATION		24. DATE		25. DATE		26. LEAD TIME	
NA		NA		NA		NA		36 MONTHS	
26. INSTRUMENT TYPE		27. SPACECRAFT		28. APPLICATION		29. PURPOSE		30. DATE	
SCATTEROMETER, TWIN 1.5-GHZ (20 CM) SIDE-LOOKING RADAR		NIMBUS F		PRO.					
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS SIDE LOOKING RADAR SCATTEROMETER IS PROPOSED TO GATHER INFORMATION ABOUT THE WIND SPEED AT THE SURFACE OF THE WORLD'S OCEANS. THE SCATTEROMETER OPERATES BY MEASURING THE RADAR CROSS-SECTION OF A PATCH OF OCEAN. THE CROSS-SECTION IS GOVERNED, AT THE RADAR FREQUENCY CHOSEN, PRIMARILY BY THE DISTURBANCE OF THE OCEAN SURFACE DUE TO THE LOCAL WIND FIELD. HENCE THE OBSERVED VALUE CAN BE USED TO ESTABLISH THE WIND SPEED. MEASUREMENTS WILL BE MADE ON A 110 KM GRID EXTENDING TO EACH SIDE OF THE SUBSATELLITE PATH FROM ABOUT 400 KM OUT TO 1100 KM. THE PROPOSED SYSTEM USES TWO COLLAPSABLE 2.25 METER-LONG ANTENNAS. THE ANTENNAS ILLUMINATE A REGION TO EACH SIDE OF THE SATELLITE WITH ANGLES OF VARYING INCIDENCE. THE SYSTEM USES A 20 WATT PEAK POWER S-BAND (3000-4000 MHZ) TRANSMITTER. CROSS-TRACK RESOLUTION IS 20 KM WITH 3 BY 55 KM INTERVALS IN WHICH NO MEASUREMENT IS MADE. RANGE RESOLUTION IS ACHIEVED BY FREQUENCY MODULATION.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>RETURNED RADAR ELECTROMAGNETIC ENERGY AT 3.00 GHZ</p>									
<p>33. MEASUREMENT RANGE</p> <p>WAVE HEIGHT FROM 1 TO 10 METERS; WIND SPEED FROM 6 TO 36 KNOTS</p>									
<p>34. PRECISION AND ACCURACY</p> <p>WIND SPEED WITHIN 1 KNOT</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
3.00		GHZ		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
15. BY		2.55 DEG		600 KM BY 60 KM FROM 1400 KM ALTITUDE	
40. ANGULAR RESOLUTION (ON-1) SPATIAL RESOLUTION					
2.55 DEG		60 KM FROM 1400 KM ALTITUDE AT 20 DEG INCIDENCE			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
1.0 DEG		MED		SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
RADAR SCATTEROMETER, 2 DEPLOYED 2.25 METER-LONG ANTENNAS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
90 LR		43. CU FT		35 WATTS	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE	
SOURC/SEN		SENSITIVE		55. SHIELDING	
56. CALIBRATION		57. DATA RECOVERY		58. FREQUENCY OF OBSERVATION	
NONE		DELAYED TELEMETRY		OVER OCEAN	
59. TELEMETRY REQUIREMENTS					
60. ADVANTAGES AND LIMITATIONS					
RADAR WAVELENGTH LONG ENOUGH TO GUARANTEE PENETRATION OF THE HEAVIEST CLOUDS AND RAIN CHOSEN TO PERMIT CONTINUOUS COVERAGE					
64. REFERENCES					
1) PIERSON, W.J. AND MOORE, R.K. (PROPOSAL FOR GLOBAL RADAR FOR OCEAN WAVES AND WINDS, NYU AND U OF KANSAS, FEB 68.***2) MOORE, R.K. AND PIERSON, W.J.: INTERNATIONAL SYMP ELECTROMAG SENSING FROM SPACE, POLYTECHNIC PRESS, 1967.					
65. HISTORICAL REMARKS					
A SIMILAR INSTRUMENT HAS BEEN PROPOSED FOR NIMBUS F (RADSCAT)					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
HIGH-RESOLUTION FABRY-PEROT ETALON SPECTROMETER (TITLE CONT.)	HRES		E03						
4. RESUME	11/10/69		0005						
5. VERSION									
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
HOVIS, W. A. JR.	GODDARD SPACE FLT CENTER		301-982-6465						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
BLAIR, L. R.	GODDARD SPACE FLT CENTER		301-982-6465						
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER		14. STATUS						
NA	NA		INACT PROPOSAL						
15. MONITOR	16. AGENCY		17. DATE						
SCHARDT, B. B.	NASA HQ/OTRS		202-952-0891						
21. VENDOR	22. LOCATION		23. DATE						
NA	NA		NA						
24. INSTRUMENT TYPE	25. PGM OFFICE		26. TELEPHONE						
INTERFEROMETER, HIGH-RESOLUTION 15-MICRON FABRY-PEROT ETALON	27. SPACECRAFT		28. DATE						
29. APPLICATION	30. PURPOSE		31. NIMBUS R						
32. PRIMARY TO DETERMINE THE VERTICAL TEMPERATURE STRUCTURE OF THE ATMOSPHERE FROM THE UPPER TROPOSPHERE TO THE STRATOSPHERE ***									
33. SECONDARY TO COMBINE THESE MEASUREMENTS WITH THOSE OBTAINED FROM TROPOSPHERE SOUNDERS YIELDING INSIGHT INTO THE INTERACTION OF THE TROPOSPHERE AND STRATOSPHERE.									
34. PRINCIPLES OF OPERATION									
<p>THE COMPENSATOR PLATE WILL BE TILTED THROUGH AN ANGLE OF APPROX 5 DEGREES PER SCAN. A SPECTRUM OF THE ATMOSPHERE WILL BE PRODUCED DIRECTLY WITH NO FOURIER TRANSFORM REQUIRED. THE INSTRUMENT WILL SCAN 60 RESOLVED ELEMENTS IN ONE SCAN. THE RECEIVED SIGNAL IS A MEASUREMENT OF THE TEMPERATURE. COMBINING THIS WITH A WEIGHTING FUNCTION RELATING WAVELENGTH OF THE SIGNAL TO ATMOSPHERIC PRESSURE GIVES THE TEMPERATURE AS A FUNCTION OF PRESSURE. THE SPECTROMETER WILL MONITOR TWO SPECTRUM INTERVALS: 14.9 TO 15.0 MICRONS FOR THE UPPER ATMOSPHERE, AND 14.0 TO 14.1 MICRONS FOR THE LOWER ATMOSPHERE.</p> <p>NOTE - THE RADIATIVE COOLER AND ZERO LEVEL REFERENCE WILL REQUIRE A DEEP SPACE VIEW PERPENDICULAR TO THE ORBITAL PLANE.</p>									
35. PHENOMENA OBSERVED									
36. THERMAL-IR ENERGY EMITTED BY THE ATMOSPHERE									
37. MEASUREMENT RANGE									
38. TEMPERATURE OF 190 TO 280 DEG K WITH S/N OF 100 AT 280 DEG K									
39. PRECISION AND ACCURACY									

36. SPECTRAL RANGE	14. TO	15. MICRONS	37. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	2.8 BY	2.8 DEG NA	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION			
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION	
46. SPECIAL REQUIREMENTS	VIEW OF DEEP SPACE			
47. COMPONENTS	INTERFEROMETER, COOLER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER	52. PEAK POWER
25 LB	0.67 CU FT	10 WATTS	3 WATTS	1.3 MTRF
53. INTERFERENCE	54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. SHIELDING
58. CALIBRATION	59. DATA RECOVERY	60. SENSITIVE	61. FREQUENCY OF OBSERVATION	
62. TELEMETRY REQUIREMENTS	BY GROUND COMMAND DELAYED TELEMETRY			
63. ADVANTAGES AND LIMITATIONS	SAMPLING RATE DURING OPERATION WILL BE 12 SAMPLES PER SECOND, HOUSEKEEPING 1 SAMPLE PER SECOND WITH 10 BIT TELEMETRY, STORAGE WOULD BE NEEDED FOR 130 BITS PER SECOND.			
64. REFERENCES	INCREASED SPECTRAL RESOLUTION - 0.002 MICRONS - EXTENDS PROFILE MEASUREMENT UPWARD TO 1-5 MILLILAB (UPPER ATMOSPHERE) LEVEL.			
65. HISTORICAL REMARKS	<p>1) HOVIS, W.A., ET AL: PROPOSAL FOR A HIGH RESOLUTION FABRY-PEROT ETALON SPECTROMETER FOR 15 MICRON TEMPERATURE INVERSION, NASA GODDARD SPACE FLIGHT CENTER, CODE 622.***2) HILLEARY, ET AL: NATURE, 209, 489 (1965).***3) WARK AND FLEMING: MONTHLY WEATHER REVIEW, 94, 351 (1966).***4) WARK, ET AL: MONTHLY WEATHER REVIEW, 95, 468 (1967).</p>			
66. DIAGRAMS				



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONIC RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. VERSION	
(TITLE CONT.)		IRLS		E25		11/10/59		0004	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CONTRACT NUMBER		10. FLASH INDEX NUMBER	
HOGAN, G.		GODDARD SPACE PLT CENTER		301-972-6465		11. TELEPHONE		12. STATUS	
KLEINBERG, J.		GODDARD SPACE PLT CENTER		301-982-6465		13. DATE		14. COMPLETION DATE	
15. TYPE		16. AGENCY		17. OFFICE		18. TELEPHONE		19. DATE	
NA		NASA		NASA HQ		20. PGM OFFICE		21. DATE	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. LEAD TIME	
SCHARDT, B.B.		NASA HQ		NASA HQ		202-962-0891		23. DATE	
22. VENDOR		23. LOCATION		24. DATE		25. DATE		26. DATE	
GODDARD SPACE PLT CENTER		GREENBELT, MARYLAND		NA		NA		NA	
26. INSTRUMENT TYPE		27. SPACECRAFT		28. PURPOSE		29. DATE		30. DATE	
DATA RELAY		PRO		NAV. NET, ERSP		NIMBUS E		PRO	
<p>PRIMARY-TO EXTEND THE OPERATIONAL UTILITY OF THE IRLS SYSTEM BY DEVELOPING AND LAUNCHING A SMALL NUMBER OF BALLOON INTERROGATION PACKAGES FOR A LARGE SCALE WIND MEASUREMENT EXPERIMENT.*** SECONDARY-TO RELAY IRLS RANGING AND SENSOR DATA TO THE CENTRAL DATA PROCESSING FACILITY IN REALTIME VIA THE ATS F SATELLITE. RETURNING DATA TO THE IRLS GIVES A NAVIGATION CAPABILITY.</p> <p>THE SAME IRLS SYSTEM FLOWN IN NIMBUS D WILL BE USED FOR THIS EXPERIMENT. TWO PARTS ARE ENVISIONED: (1) BALLOON EXPERIMENT - FIVE BALLOONS WILL BE LAUNCHED AT DIFFERENT LEVELS BETWEEN 20 AND 200 MILLIBARS WITH LIGHTWRIGHT, LOW-HAZARD IRLS PACKAGES. THE BALLOONS WILL BE INSTRUMENTED TO DETERMINE THE PERFORMANCE OF EACH COMPONENT COMPRISING THE BALLOON PACKAGE. THE NIMBUS F DATA-RELAY LINK WILL BE USED TO OBTAIN BALLOON POSITION IN REAL TIME. THE RANGE MEASUREMENT WILL ALSO BE STORED IN THE IRLS MEMORY FOR LATER READOUT; (2) NAVIGATION EXPERIMENT - FIVE NAVIGATION PLATFORMS WILL BE DEPLOYED. INTERROGATION OF A BUOY WILL BE PERFORMED BY NIMBUS E IN THE NORMAL MANNER. POSITION LOCATION OF THE BUOY WILL BE OBTAINED IN REAL TIME AND WILL BE PROVIDED TO THE USER AS REQUIRED. INITIATION OF THE RANGE MEASUREMENT WILL BE BY ONE OF THE OTHER FOUR NAVIGATING VEHICLES WHEN NIMBUS E IS IN VIEW. THE RANGE MEASUREMENT WILL BE RELAYED FROM NIMBUS E IN REALTIME TO THE DATA PROCESSING CENTER VIA THE ATS F. POSITION LOCATION COORDINATES WILL BE COMPUTED AT THE DATA PROCESSING CENTER, THEN RELAYED BACK TO THE NAVIGATING VEHICLE VIS ATS F DIRECTLY TO THE PLATFORM WITHIN 3 MINUTES OF INITIATION OF OPERATION.</p> <p>32. PHENOMENA OBSERVED</p> <p>DATA SHIPPED FROM IRLS PACKAGES ON BALLOONS AND OTHER PLATFORMS.</p> <p>33. MEASUREMENT RANGE</p> <p>34. PRECISION AND ACCURACY</p> <p>LOCATION ACCURACY OF ABOUT 2 KM; NOISE FIGURE WILL BE ABOUT 4 DB</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
2.253		GHZ			
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED	
45. INCLINATION		46. SPECIAL REQUIREMENTS		SUN-SYNCH RETROGRADE	
47. COMPONENTS		48. WEIGHT		49. VOLUME	
		50. AVERAGE POWER		51. STANDBY POWER	
		52. PEAK POWER		53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. SHIELDING		59. DATA RECOVERY	
60. CALIBRATION		61. FREQUENCY OF OBSERVATION		62. TELEMETRY REQUIREMENTS	
NONE		REALTIME TELEMETRY		ON COMMAND	
370 INTERROGATIONS PER ORBIT (1000 BALLOONS GLOBAL), 160 BITS PER BALLOON PER INTERROGATION, READ INTO 100,000 BIT MEMORY, TRANSMITTED IN REAL TIME VIA ATS F SYNCHRONOUS SPACECRAFT TO GROUND.					
63. ADVANTAGES AND LIMITATIONS					
64. REFERENCES					
1) HOGAN, G. AND KLEINBERG, L.: PROPOSAL FOR A TECHNOLOGICAL NAV/NET EXPERIMENT BASED ON THE INTERROGATION RECORDING AND LOCATION SYSTEM FOR THE NIMBUS E SPACECRAFT.***2) FEASIBILITY OF GLOBAL OBSERVATION AND ANALYSIS EXPERIMENT, NAS PUB 1290.					
65. HISTORICAL REMARKS					
SPACECRAFT PACKAGE ESSENTIALLY THE SAME AS ON NIMBUS D					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
IONIZING-RADIATION EXPERIMENT	IONTEC	E33A							
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
		11/10/69							
TISSUE-EQUIVALENT IONIZATION CHAMBER (TEIC)			8. TELEPHONE						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION								
HOLLY, F.E.	AIR FORCE WEAPONS LAB	505-247-1711							
9. CO-INVESTIGATOR	10. ORGANIZATION								
HEWLETT, CAPT. T.	AIR FORCE WEAPONS LAB	505-247-1711							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS					
NA	NA	NA	NA	INACT PROPOSAL					
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HDOTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
		NA							
26. INSTRUMENT TYPE									
COUNTER, 3 DOSIMETRIC TISSUE-EQUIVALENT IONIZATION CHAMBER									
27. SERIAL									
UNC.									
28. APPLICATION									
29. SPACECRAFT									
30. PURPOSE									
BIOL									
31. PRINCIPLES OF OPERATION									
<p>RADIOBIOLOGICAL EXPERIMENTS HAVE SHOWN THAT THE ENERGY DEPOSITION PER UNIT PATH LENGTH AND THE TOTAL ENERGY ABSORBED CAN BE DIRECTLY RELATED TO BIOLOGICAL EFFECT. THE TOTAL ENERGY DEPOSITED, OR DOSE, IS THE MOST IMPORTANT SINGLE FACTOR ASSOCIATED WITH THE RADIATION FIELD IN DETERMINING FUNDAMENTAL BIOLOGICAL EFFECTS. THE TISSUE EQUIVALENT IONIZATION CHAMBER (TEIC) IS AN EXTREMELY SENSITIVE DIRECT READING DOSIMETER CONSISTING OF A THIN-WALLED, GAS-FILLED SPHERICAL CAVITY. BOTH THE WALLS AND THE FILLING GAS ARE DESIGNED TO BE TISSUE EQUIVALENT. A SUBSTANCE IS TISSUE EQUIVALENT WHEN THE ATTENUATION AND ABSORPTION OF NUCLEAR RADIATION IN TISSUE IS CLOSELY DUPLICATED IN THE SAMPLE MATERIAL. THE CHAMBER IS POINTED AWAY FROM THE EARTH. THE CHARGE PRODUCED WITHIN THE CHAMBER BY INCOMING RADIATION FROM SPACE IS COLLECTED BY ELECTRODES AND AMPLIFIED BY AN ELECTROMETER-TYPE PREAMPLIFIER. THE SIGNAL IS THEN PROCESSED BY MAGNETIC AMPLIFIERS WHICH PRODUCE AN ANALOG OUTPUT OF 0 TO 5 VOLTS. EXACT DETAILS OF THE ANALOG TO DIGITAL CONVERTER AND BINARY STORAGE USED WILL DEPEND ON THE PAYLOAD DATA HANDLING EQUIPMENT.</p>									
32. PHENOMENA OBSERVED									
SOLAR FLARE RADIATION AND COSMIC RADIATION OF GALACTIC ORIGIN.									
33. MEASUREMENT RANGE									
FLARE PROTONS 160/SEC/SQ CM MAX; COSMIC PARTICLES 2.5/SEC/SQ CM									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH	
180.	DEG: NA	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	1 MED
45. SPECIAL REQUIREMENTS	46. POLAR	NA
EXTENSIVE SHIELDING FROM ALL NUCLEAR RADIATION SOURCES ON NIMBUS THREE IONIZATION CHAMBERS. SHIELDING		
47. COMPONENTS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
6 LB.	0.07 CU FT	1 WATT
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
SENSITIVE	1 SEE ITEM 46	
54. CALIBRATION	55. DATA RECOVERY	56. FREQUENCY OF OBSERVATION
	1 DELAYED TELEMETRY	CONTINUOUS
57. TELEMETRY REQUIREMENTS		
EACH OF 3 CHANNELS (ONE PER IONIZATION CHAMBER) SHOULD BE SAMPLED EVERY 4 SECONDS		
58. ADVANTAGES AND LIMITATIONS		
NO MOVING PARTS, REQUIRES NO WINDOW: WILL REQUIRE EXTENSIVE SHIELDING FROM ON-BOARD NUCLEAR RADIATION SOURCES		
59. REFERENCES		
<p>1) PROPOSAL FOR AN IONIZING RADIATION EXPERIMENT ON THE NIMBUS-E MISSION, APVL/USAF, MAR 68.***2) LANGHAM, W.: BIOLOGICAL EFFECTS OF IONIZING RADIATION, JOUR AEROSPACE MED, V. 36, 2, 1965.***3) REAGAN, ET AL: PROTON-ELECTRON SPECTROMETER EXPERIMENTS ON GEMINI-4 AND GEMINI-7, FINAL REPORT CONTRACT NAS 9-1597, 1966.</p>		
60. HISTORICAL REMARKS		
IONTEC AND IONLET ARE BOTH PART OF IONIZING-RADIATION EXPERIMENT		
61. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
IONIZING-RADIATION EXPERIMENT	IONLET		E33B						
(TITLE CONT.)	4. RESUME	5. VERSION							
LINEAR-ENERGY-TRANSFER SPECTROMETER (LET)	11/10/69		0005						
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION								
HOLLY, F. E.	AIR FORCE WEAPONS LAB	505-247-1711							
9. CO-INVESTIGATOR	10. ORGANIZATION								
HEWLETT, CAPT. T.	AIR FORCE WEAPONS LAB	505-247-1711							
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	INACT	PROPOSAL				
18. MONITOR	19. AGENCY	20. PMO OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA RDQTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. CLOSURE DATE	25. LEAD TIME						
		NA	NA						
26. INSTRUMENT TYPE	27. REMARKS								
SPECTROMETER, SOLID-STATE LINEAR-ENERGY-TRANSFER (LET)	UNC								
28. APPLICATION	29. SPACECRAFT								
BIOLOGICAL	NIMBUS E								
30. PURPOSE									
PRIMARY-TO MEASURE THE LINEAR ENERGY TRANSFER SPECTRA RESULTING FROM SOLAR FLARE PARTICLES HAVING ENERGIES GREATER THAN 17 MEV OVER THE GEOMAGNETIC POLES. ***SECONDARY-TO MEASURE THE LINEAR ENERGY TRANSFER SPECTRA RESULTING FROM GEOMAGNETICALLY TRAPPED PARTICLES OVER THE SOUTH ATLANTIC; TO PROVIDE DIRECT EXPERIMENTAL TESTS OF NASA AND USAF MISSION PLANNING COMPUTER CODES.									
31. PRINCIPLES OF OPERATION									
THE LINEAR ENERGY TRANSFER (LET) SPECTROMETER CONSISTS OF A SOLID STATE DETECTOR SYSTEM FOR DETERMINING THE NUMBER OF LOW ENERGY (HIGH LINEAR ENERGY TRANSFER) PARTICLES THAT COMPRISE THE BIOLOGICALLY SIGNIFICANT RADIATION DOSE. MEASUREMENTS WILL BE MADE TO DETECT RADIATION FROM TRAPPED PARTICLES IN THE VAN ALLEN BELTS, FROM PRIMARY COSMIC RADIATION, AND FROM POSSIBLE SOLAR FLARE CHARGED PARTICLES. PROTONS BELOW 18.5 MEV WILL BE ANALYZED ACCORDING TO ENERGY LOSS IN THE SOLID STATE DETECTOR AND PLACED INTO FIVE ENERGY CHANNELS: 18.5 - 14.0, 14.0 - 10.0, 10.0 - 6, 6 - 2, AND 2 - 0.5 MEV. ALPHA PARTICLES BETWEEN 18.5 AND 75 MEV WILL BE RECORDED IN A SEPARATE CHANNEL. ALPHA PARTICLES BELOW 18.5 MEV WILL BE EXTREMELY RARE COMPARED TO PROTONS AND WILL NOT BE SEPARATED FROM PROTON COUNTS OF THE SAME ENERGY RANGE. PROTONS WITH ENERGIES GREATER THAN 75 MEV WILL BE PROCESSED IN ONE CHANNEL OF LOW LET DATA TO PROVIDE INFORMATION ON THE NUMBER OF HIGH ENERGY PARTICLES THAT CREATED THE RADIATION DOSE. THE SYSTEM WILL MEASURE THE RANGE OF HIGH LET BETWEEN 28 AND 424 KILOELECTRON VOLTS/MICRON IN MUSCLE TISSUE AND ALSO RECORD ALL PARTICLES WITH LET VALUES LESS THAN 28 KILOELECTRON VOLTS/MICRON.									
32. PHENOMENA OBSERVED									
COSMIC, SOLAR FLARE, AND TRAPPED RADIATION IN THE VAN ALLEN BELTS									
33. MEASUREMENT RANGE									
LINEAR ENERGY TRANSFER FROM 28-424 KEV/MICRON IN MUSCLE TISSUE									
34. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	0.5 TO 75. KEV	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	180.	39. GROUND SWATH	SEE ITEM 31
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	42. POINTING ACCURACY	43. POINTING RATE
NA	NA	44. ALTITUDE	45. INCLINATION
NA	NA	46. SPECIAL REQUIREMENTS	HIGH
47. COMPONENTS	0 TO 100 DEGREE F OPERATING TEMPERATURE RANGE DESIRED		
SPECTROMETER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
3 LB	0.07 CU FT	1 WATT	
52. INTERFERENCE	53. INTERFERENCE	54. THERMAL INTERFERENCE	55. SHIELDING
SENSITIVE	56. DATA RECOVERY	57. FREQUENCY OF OBSERVATION	
58. CALIBRATION	59. ADVANTAGES AND LIMITATIONS		
60. TELEMETRY REQUIREMENTS	61. DELAYED TELEMETRY		
7 CHANNELS OF DATA AND ONE TEMP CHANNEL WHICH SHOULD BE SAMPLED EVERY 16 SEC. THE DATA CHANNELS SHOULD BE SAMPLED EVERY 0.2 SEC ALTHOUGH ADJUSTMENT FOR LESS FREQUENT SAMPLING IS POSSIBLE.			
NO MOVING PARTS; LARGE UNOBSTRUCTED VIEWING ANGLE REQUIRED.			
64. REFERENCES			
1) PROPOSAL FOR AN IONIZING RADIATION EXPERIMENT ON THE NIMBUS-2 MISSION, AFPL/USAF, MAR 68.***2) LANGHAM, W.: BIOLOGICAL EFFECTS OF IONIZING RADIATION, JOUR AEROSPACE MED, V. 36, 2, 1965.			
***3) REAGAN, ET AL: PROTON-ELECTRON SPECTROMETER EXPERIMENTS ON GEMINI-4 AND GEMINI-7, FINAL REPORT CONTRACT WAS 9-1587, 1966.			
65. HISTORICAL REMARKS			
IONLET AND IONTEC ARE BOTH PART OF IONIZING-RADIATION EXPERIMENT			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
LIMB-RADIANCE INVERSION EXPERIMENT	LRAIN	E01							
(TITLE CONT.)	4. DATE	5. VERSION							
	11/10/69	0005							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
BATES, J.C.	HONEYWELL AEROSPACE	612-331-4141							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
KING, DR. JEAN I.P.	GCA TECHNOLOGY DIVISION	617-275-9000							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
			01/69		PRELIM DSGN				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA JDOOTS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
SANTA BARBARA RES CENTER	GOLETA, CALIFORNIA	06/72	40 MONTHS						
26. INSTRUMENT TYPE									
RADIOMETER, 15-MICRON INFRARED SCANNING PRECISION									
28. APPLICATION	29. SPACECRAFT								
MET. ATM-PHYS	NIMBUS R								
30. PURPOSE									
PRIMARY-TO TEST INVERSION THEORIES FOR RADIANCE/TEMPERATURE MEASUREMENTS ALONG THE EARTH'S LIMB. **SECONDARY-TO PROVIDE DATA ON THE ATMOSPHERIC TEMPERATURE-ALTITUDE STRUCTURE ABOVE 30 KM ON A GLOBAL BASIS OVER AN EXTENDED PERIOD OF TIME. THIS DATA COULD PROVIDE A FIRST STEP TOWARD DEVELOPING LONG-RANGE WEATHER FORECASTING TECHNIQUES.									
31. PRINCIPLES OF OPERATION									
<p>THE EXPERIMENT WILL CONSIST OF SPACEBORNE MEASUREMENTS OF RADIANCE ALONG A TANGENT TO THE EARTH'S SURFACE. THE MEASUREMENT WILL INCLUDE A RANGE OF ALTITUDES FROM 20 TO 80 KILOMETERS. THE EXPERIMENT WILL BE CARRIED OUT USING A PRECISION SCANNING RADIOMETER OPERATING IN THE 15-MICRON CO2 BAND WITH A 2.3-MICRON BANDWIDTH AND A VERTICAL RESOLUTION OF APPROXIMATELY TWO KILOMETERS AT THE EARTH'S HORIZON (SCAN RATE = 1 HZ). A SIMPLE BUT ACCURATE ATTITUDE-DETERMINATION SYSTEM WILL BE USED TO FIX ACCURATELY THE LINE OF SIGHT OF THE RADIOMETER TO THE EARTH'S ACTUAL HORIZON. THIS SYSTEM WILL CONSIST OF A SUN-SENSOR-GYROSCOPE-UNIT ALLOWING LINE OF SIGHT TO BE DETERMINED WITH APPROXIMATELY TWO-KILOMETER RESOLUTION. THE INFRARED RADIOMETER SUBSYSTEM INCLUDES A SCANNING HEAD, OPTICAL SYSTEM, CHOPPER, DETECTOR (MERCURY-CADMIUM-TELURIDE), AND DETECTOR COOLER. THE DETECTOR IS OPERATED AT APPROXIMATELY LIQUID-NITROGEN TEMPERATURE, WHICH IS MAINTAINED BY MEANS OF A STORED-SOLID-METHANE COOLER. APPLYING INVERSION TECHNIQUES TO THE RADIOMETER DATA WILL YIELD A MORE ACCURATE TEMPERATURE-ALTITUDE STRUCTURE OF THE EARTH'S ATMOSPHERE ABOVE 25 KM THAN HAS BEEN OBTAINED PREVIOUSLY.</p>									
32. PHENOMENA OBSERVED									
IR ENERGY EMITTED BY ATMOSPHERE ALONG LINE OF SIGHT									
33. MEASUREMENT RANGE									
A DYNAMIC RANGE OF 700 TO 1 (220 TO 270 DEGREES KELVIN)									
34. PRECISION AND ACCURACY									
TEMPERATURE WITHIN 5 CENTIGRADE DEGREES, ALTITUDE WITHIN 1 KM									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
14.0 TO 16.3 MICRONS NA		
38. FIELD OF VIEW	39. GROUND SWATH	
0.03 DEG NA		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
1.0 DEG		45. INCLINATION
46. SPECIAL REQUIREMENTS		
PRELAUNCH WARMUP: CIRCULAR ORBITAL WITHIN 50 KM		
47. COMPONENTS		
RADIOMETER; COOLER; ATTITUDE ALIGNMENT AND INTEGRATION ASSEMBLIES		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
51. STANDBY POWER	52. PEAK POWER	53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. INTERFERENCE	58. SHIELDING	59. DATA RECOVERY
60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
62. TELEMETRY REQUIREMENTS	63. ADVANTAGES AND LIMITATIONS	
BLACKBODY STANDARD	DELAYED TELEMETRY	2800 PROFILES/DAY
DATA WILL BE RECORDED ON NIMBUS HIGH DATA RATE STORAGE SYSTEM (HDBSS). DATA TRANSMISSION IS ON S-BAND TO THE ALASKA AND ROSMAN TRACKING STATIONS. HOUSEKEEPING DATA IS TRANSMITTED ON VHF BEACON		
THE TEST OF INVERSION THEORIES WILL REQUIRE A SERIES OF SIMULTANEOUS TEMPERATURE SOUNDINGS ACQUIRED BY ROCKET PROBES.		
1) NIMBUS E LIMB RADIANCE INVERSION EXPERIMENT, TECHNICAL PROPOSAL, V.1, HONEYWELL AEROSPACE, FEB. 68.		
65. HISTORICAL REMARKS		
66. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
METEOR-FLASH ANALYSIS EXPERIMENT	MEFAN	E32							
(TITLE CONT.)	4. RESUME	5. VERSION							
	6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE						
	MASTBUP, F.N.	TRW SYSTEMS	213-679-8711-X6920						
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
COUR-PALAYS, B.G.	NASA/HSC	713-483-2666							
12. CONTRACT TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PCM OFFICE	21. TELEPHONE						
SCHARDT, B. B.	NASA HDQTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. FLIGHT	25. LEAD TIME						
TRW SYSTEMS	REDONDO BEACH, CALIF.	NA	14 MONTHS						
26. INSTRUMENT TYPE	27. INSTRUMENT								
RADIOMETER, 3-CHANNEL PASSIVE UV OPTICAL	PRO								
28. APPLICATION	29. SPACECRAFT								
ASTR	NIMBUS E								
30. PURPOSE									
<p>PRIMARY-TO YIELD NEW QUANTITATIVE DATA ON FAR UV RADIATION FROM TERRESTRIAL METEORS. THE CHANNELS HAVE BEEN SELECTED TO LOOK FOR THE IRON, MAGNESIUM, AND SILICON COMPONENTS IN THE TOTAL METEOR RADIATION. *** SECONDARY-TO DETERMINE WHICH OF THE THREE CHANNELS PROVIDES BEST SIGNAL/NOISE RATIO FOR THE DETECTION OF METEORS.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS EXPERIMENT IS DESIGNED TO COUNT AND ANALYZE OPTICAL METEOR FLASHES ON THE NIGHT SIDE OF THE EARTH. OPTICAL DATA WILL BE RECORDED SIMULTANEOUSLY IN THREE WAVELENGTH BANDS 0.22-0.26, 0.26-0.30, AND 0.30-0.40 MICRONS USING A THREE CHANNEL RADIOMETER. THE OPTICAL OBSERVABLES, MAXIMUM METEOR INTENSITY, INTEGRATED METEOR INTENSITY, AND BACKGROUND INTENSITY WILL BE MEASURED IN ALL THREE WAVELENGTH BANDS. THE EXPERIMENT METHOD IS TO POINT TOWARDS THE DARK EARTH. ALL CHANNELS ARE ALIGNED TO COVER NEARLY IDENTICAL FIELDS OF VIEW. THE RADIOMETER IS EXPECTED TO SENSE THE METEOR RADIATION AGAINST THE EARTH'S BACKGROUND (NIGHT GLOW) AND THE RADIOMETER ELECTRONICS WILL RECORD ELECTRICAL QUANTITIES PROPORTIONAL TO METEOR OBSERVABLES. ASIDE FROM THE THREE RADIO-METER SENSOR CHANNELS, THE EXPERIMENT PACKAGE INCLUDES AN IN-FLIGHT CALIBRATION LAMP AND A FOURTH RADIOMETER CHANNEL DESIGNED TO PROTECT THE RADIOMETER SENSOR CHANNEL AGAINST DAMAGE FROM EXCESSIVE BACKGROUND ILLUMINATION LEVELS. THE IN-FLIGHT CALIBRATION LAMPS ARE INTENDED TO CHECK FOR MAJOR CHANGES IN SENSOR CHANNEL CALIBRATION EVERY FIVE MINUTES DURING FLIGHT.</p>									
32. PHENOMENA OBSERVED									
EMITTED UV RADIATION FROM METEORS TRAVELING THROUGH ATMOSPHERE									
33. MEASUREMENT RANGE									
EXPECTED METEOR COUNT RATE = 0.003 TO 0.012 METEORS/SECOND									
34. PRECISION AND ACCURACY									
MINIMUM SIGNAL TO NOISE = 5:1; MAXIMUM SIGNAL TO NOISE = 2600:1									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.22 TO 0.40 MICRON NA		
38. FIELD OF VIEW	39. GROUND SWATH	
30. BY 30. DEG NA		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
10.0 DEG	10.0 DEG/SEC	NEO HIGH
45. SPECIAL REQUIREMENTS	46. POSIGRADE	
NO OPERATION DURING FULL MOON OR SIGNIFICANT AURORA ACTIVITY		
47. COMPONENTS		
RADIOMETER, CALIBRATION LAMP, ELECTRONICS ASSEMBLY		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
14 LB	0.41 CU FT	7 WATTS
51. INTERFERENCE	52. INTERFERENCE	53. SHIELDING
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. INTERFERENCE	58. INTERFERENCE	59. INTERFERENCE
60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
2 SEC EVERY 5 MINUTES	DELAIED TELEMETRY	EVERY NIGHT ORBIT
62. TELEMETRY REQUIREMENTS		
ANALOG TO DIGITAL CONVERSION OF OUTPUTS FROM THREE DATA CHANNELS (1 SAMPLE/10 SECONDS); ALSO EXPERIMENT STATUS, POWER SUPPLY STATUS, CALIBRATION LAMP STATUS, ELECTRONICS & SENSOR TEMPERATURE.		
63. ADVANTAGES AND LIMITATIONS		
64. REFERENCES		
1) PROPOSAL TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR A METEOR FLASH ANALYZER EXPERIMENT FOR NIMBUS, TRW SYSTEMS GROUP, FEB 68.		
65. HISTORICAL REMARKS		
66. DIAGRAMS		



INSTRUMENT RESUME			
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE	MICROWAVE REFRACTION/OCCULTATION EXPERIMENT		
(TITLE CONT.)			
2. ACRONYM	3. EXP NO.	4. DATE	
MIRO	E10	11/10/69 0005	
5. VARIATION			
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	9. CO-INVESTIGATOR
LUSIGNAN, DR. R.	STANFORD UNIV	415-321-3300	DA ROSA, A.
10. ORGANIZATION	11. TELEPHONE		
STANFORD UNIV	415-321-3300		
12. TYPE	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. DATE
NA	NA	NA	NA
16. MONITOR	17. AGENCY	18. PGM OFFICE	19. TELEPHONE
SCHARDT, B. B.	NASA HQ/RTS	OSSA/SRN	202-962-0891
21. VENDOR	22. LOCATION	23. DATE	24. LEAD TIME
PHILCO-FORD		NA	NA
25. INSTRUMENT TYPE	26. SPACECRAFT		
TRANSPONDER, COHERENT MICROWAVE	NIMBUS E		
27. APPLICATION	28. PURPOSE		
PRO	PRIMARY-TO DETERMINE VERTICAL PROFILE OF DENSITY AND PRESSURE DOWN TO 400 MB WITHOUT WATER VAPOR INFORMATION, AND TO 600 MB WITH 10 PERCENT ACCURACY WATER VAPOR DATA.***SECONDARY - TO EVALUATE METHODS OF CORRECTING FOR WATER VAPOR BETWEEN 400 AND 700 MB.		
29. PRINCIPLES OF OPERATION	MICROWAVES TRANSMITTED THROUGH THE ATMOSPHERE ARE REFRACTED WITH THE REFRACTION PROPORTIONAL TO THE ATMOSPHERIC DENSITY. TRANSMISSION OF A MODULATED CARRIER BETWEEN TWO CO-ORBITING SATELLITES SPACED SO THAT THE BEAM CUTS THE ATMOSPHERE AT A GIVEN HEIGHT PERMITS MEASUREMENT OF THE EFFECTS OF REFRACTION IN TERMS OF PATH LENGTH VARIATION, MODULATION PHASE VARIATION, AND ATTENUATION. AT LOW ALTITUDES THE RAY IS ALSO REFRACTED BY WATER VAPOR AND THIS EFFECT MUST BE SEPARATED FROM AIR DENSITY EFFECT. DENSITY PROFILES CAN BE CONVERTED TO PRESSURE PROFILES BY ASSUMING A GIVEN SCALE HEIGHT, BY INDEPENDENT TEMPERATURE PROFILES, OR BY USE OF EMPIRICAL ORTHOGONAL FUNCTIONS IN AN OPERATIONAL SYSTEM USING SEVERAL SUBSATELLITES. IN THE EXPERIMENT A SUBSATELLITE WITH A SLOW DRIFT RATE RELATIVE TO NIMBUS IS REQUIRED TO GIVE READINGS AT DIFFERENT ALTITUDES.		
30. PHENOMENA OBSERVED	PATH LENGTH VARIATION, MODULATION PHASE, SIGNAL AMPLITUDE.		
31. MEASUREMENT RANGE	PRESSURES OF 10 TO 300 MB; 600 MB WITH WATER VAPOR DATA		
32. PRECISION AND ACCURACY	3 CM PATH LENGTH PRECISION AT 5 GHZ; 1 MB ACCURACY ABOVE 300 MB		

29. SPECTRAL RANGE	30. SPECTRAL RESOLUTION	31. RANGE CONSTANT
5.	NA	NA
32. FIELD OF VIEW	33. GROUND SWATH	
0.04 BY 35.	DEG 1.5 KM BY 700 KM FROM 1100 KM ALTITUDE	
34. ANGLE OF RESOLUTION	35. SPATIAL RESOLUTION	
0.04	DEG 1.5 KM FROM 1100 KM ALTITUDE	
36. POINTING ACCURACY	37. POINTING RATE	38. INCLINATION
30.	DEG NA	POLAR NA
39. SPECIAL REQUIREMENTS		
SUBSATELLITE WITH TRANSPONDER		
40. COMPONENTS		
COHERENT PHASE LOCK TRANSPONDER, OSCILLATOR, PARABOLIC ANTENNA		
41. WEIGHT	42. AVERAGE POWER	43. PEAK POWER
20 LB	0.3 CU FT	21 WATTS
44. INTERFERENCE	45. INTERFERENCE	46. SHIELDING
24 MON	24 MON	
47. SOURCES	48. DATA RECOVERY	49. FREQUENCY OF OBSERVATION
IN CONJUNCTION W/GROUND DELAYED TELEMETRY	EVERY 10 SECONDS	
50. ADVANTAGES AND LIMITATIONS		
VERTICAL PROFILE INDEPENDENT OF ATMOSPHERIC STATE; ACCURACY REQUIRES KNOWLEDGE OF WATER VAPOR BETWEEN 400 AND 600 MB.		
51. REFERENCES		
1) PROPOSAL FOR A MICROWAVE OCCULTATION EXPERIMENT ON NIMBUS E, STANFORD ELECTRONICS LABORATORIES.***2) STANFORD UNIV SPINMAP FINAL REPORT (1966).		
52. HISTORICAL REMARKS		
53. DIAGRAMS		

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM		3. EXP NO						
NEAR-INFRARED MULTIDETECTOR GRATING SPECTROMETER	NIRMUL E04		11/10/69 0005						
(TITLE CONT.)									
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION		8. TELEPHONE						
SHAW, DR. J.H.	OHIO STATE UNIVERSITY		614-293-7968						
9. CO-INVESTIGATOR	10. ORGANIZATION		11. TELEPHONE						
CHAHINE, DR. M.T.	JET PROPULSION LAB		213-354-2144						
12. CONTRACT NUMBER	13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. STAFF DATE		16. CONTRACT STATUS		
NA	NA		NA		NA		INACT PROPOSAL		
18. MONITOR	19. AGENCY		20. PGM OFFICE		21. TELEPHONE				
SCHADT, R.	NASA HQDTRS		LOSSA/SRN		202-962-0891				
22. VENDOR	23. LOCATION		24. DATE		25. LEAD TIME				
JET PROPULSION LAB	PASADENA, CALIFORNIA		NA		36 MONTHS				
26. INSTRUMENT TYPE	27. INSTRUMENT TYPE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE		
SPECTROMETER, NEAR-IR MULTIDETECTOR GRATING							NIRBUS E		
<p>PRIMARY-TO MEASURE (A) THE TEMPERATURE PROFILE OF THE ATMOSPHERE UP TO THE 1 MB LEVEL, (B) THE WATER-VAPOR DISTRIBUTION, (C) THE SURFACE OR CLOUD-TOP TEMPERATURE, (D) THE CLOUD AMOUNT IN THE FIELD OF VIEW, (E) THE EMISSION FROM AURORAL N AND OH IN THE AIRGLOW ON THE DARK SIDE OF THE EARTH *** SECONDARY-TO PROVE THE UTILITY OF THE PROPOSED INSTRUMENT.</p> <p>31. PRINCIPLES OF OPERATION</p> <p>RADIATION FROM THE EARTH IS COLLECTED BY A TELESCOPE AND REFLECTED BY A PLANE MIRROR ONTO THE ENTRANCE SLIT OF THE SPECTROMETER. JUST BEFORE REACHING THE SLIT, A TUNING-FORK CHOPPER INTERRUPTS THE RADIATION AT 300 CPS. THE DETECTORS RESPOND TO THE DIFFERENCES IN RADIANCE BETWEEN CHOPPER AND EARTH. KNOWLEDGE OF THE RADIANCE OF THE CHOPPER YIELDS THE ABSOLUTE VALUE OF THE EARTH RADIANCE. PART OF THE BEAM FALLS ON A PARABOLOIDAL EBERT MIRROR PLACED BEHIND THE SLIT. THE COLLIMATED RADIATION IS REFLECTED BACK TO THE EBERT MIRROR AND FROM THERE TO THE SPECTRAL PLANE. THE SPECTRAL PLANE CONTAINS THE DETECTOR ASSEMBLY. ISOLATION FILTERS IN FRONT OF THE INDIVIDUAL DETECTORS REJECT ALL BUT THE DESIRED WAVELENGTHS WITH A REJECTION RATIO OF 10,000. EACH DETECTOR HAS AN OPTICAL ASSEMBLY CONSISTING OF A FIELD LENS AND A CONDENSING LENS IN WHICH THE DETECTING ELEMENT IS IMMERSED. THE DETECTOR SIGNAL PASSES THROUGH A PREAMP AND AN INTERMEDIATE AMPLIFIER. THE OUTPUT SIGNAL IS DEMODULATED SYNCHRONOUSLY WITH THE CHOPPER FREQUENCY AND THEN INTEGRATED FOR 10 SECONDS. ALL DETECTOR OUTPUTS ARE INTEGRATED SIMULTANEOUSLY AND THEN SAMPLED IN SEQUENCE.</p> <p>32. PHENOMENA OBSERVED</p> <p>RADIATION FROM EARTH AND ATMOSPHERE IN 1-6 MICRON REGION</p> <p>33. MEASUREMENT RANGE</p> <p>TEMP-SURFACE TO 1 MB LEVEL; WATER VAPOR 400 TO 1000 MB LEVEL</p> <p>34. PRECISION AND ACCURACY</p> <p>TEMPERATURE +/- 20 PERCENT; CLOUD-TOP HEIGHT WITHIN 100 MB</p>									

35. SPECTRAL RANGE	0.9 TO 6.0 MICRONS	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	3.4 BY 0.7 DEG	39. GROUND SWATH	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
3.4 DEG	36 BY 7 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
10.0 DEG	0.033 DEG/SEC MED	POLAR	NA
46. SPECIAL REQUIREMENTS			
FIELD OF VIEW MUST BE CLEAR OF OBJECTS			
47. COMPONENTS			
SPECTROMETER OPTICS, DETECTOR, AMPLIFIERS, DEMODULATORS, FILTERS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
30 LB	2.5 CU FT	25 WATTS	8 WATTS
52. INTERFERENCE	53. MAGNETIC INTERFERENCE	54. NUCLEAR RADIATION	55. SHIELDING
SOURCE/SEN.		SENSITIVE SHUTTERS AND COOLERS	
56. CALIBRATION	57. DATA RECOVERY	58. FREQUENCY OF OBSERVATION	
ONCE EACH MINUTE	DELATED TELEMETRY	CONTINUOUS	
59. TELEMETRY REQUIREMENTS			
MINIMUM BIT RATE=2000 BPS; TOTAL BITS PER ORBIT = 500,000.			
TWO DATA CHANNELS REQUIRED, ONE FOR CLOUD COVER DETECTORS AND ENGINEERING DATA AND ONE FOR THE 35 DETECTOR CHANNELS.			
60. ADVANTAGES AND LIMITATIONS			
NON-SCANNING (NO MOVING PARTS); CRITICAL TEMPERATURE CONTROL REQUIRED, SUN SHIELDING REQUIRED.			
61. REFERENCES			
1) SHAW, DR. J.H., ET AL: NEAR-INFRARED MULTIDETECTOR GRATING SPECTROMETER, OHIO STATE UNIVERSITY/JPL (1968)			
2) KAPLAN, JOSA, V.49, 1004 (1959). ***3) HILLEARY, ET AL, NATURE, 309, 489 (1967). ***4) CHANEY, ET AL: APPLIED OPTICS, 6, 347, (1967).			
62. HISTORICAL REMARKS			
THIS PROPOSAL WAS UPDATED AND RESUBMITTED FOR NIRBUS F.			
63. DIAGRAM			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	OCEAN-SURFACE-TEMPERATURE MICROWAVE RADIOMETER		2. ACRONYM	3. EXP NO					
(TITLE CONT.)			OSTMR	E13					
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE	9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	12. CONTRACT NUMBER	13. CONTRACT TYPE	14. FLASH INDEX NUMBER	15. START DATE
EWING, DR. G. C.	WOODS HOLE OCEANOGRAPHIC	617-548-1400-X237	JONES, A. C.	NORTH AMERICAN ROCKWELL	714-632-8111	NA	NA	INACT PROPOSAL	11/10/69
16. MONITOR	17. STATUS	18. AGENCY	19. AGENCY	20. PGM OFFICE	21. TELEPHONE	22. DATE	23. LEAD TIME	24. DATE	25. MONTHS
SCHARDT, B. B.	NASA HQ/TRS	OSMA/SRN	202-962-0891	NA	36 MONTHS				
26. INSTRUMENT TYPE	RADIOMETER, 2.7-GHZ GAIN-STABILIZED DICKE PASSIVE MICROWAVE. PRO								
28. APPLICATION	OCEAN, NET								
30. PURPOSE	PRIMARY-TO MEASURE GLOBAL SEA SURFACE TEMPERATURE ON A SEMI-DIURNAL WEATHER SCHEDULE *** SECONDARY - TO SUPPORT MARINE METEORLOGY AND OTHER COMMERCIAL AND PUBLIC ENTERPRISES BENEFITTING FROM THESE SCIENTIFIC SERVICES.								
<p>31. PRINCIPLES OF OPERATION</p> <p>A PASSIVE MICROWAVE RADIOMETER OPERATING AT 2.7 GHZ TO DETECT SEA SURFACE TEMPERATURE WITH A THERMAL RESOLUTION BETTER THAN 1 K DEGREE ABSOLUTE AND 0.1 DEGREE RELATIVE IS PROPOSED. THE RADIOMETER IS BASICALLY A SENSITIVE MICROWAVE RECEIVER WHICH RESPONDS TO THERMAL RADIATION INCIDENT UPON THE ANTENNA. THE SYSTEM CONSISTS OF A DICKE RADIOMETER MODIFIED FOR GAIN STABILIZATION AND CONTINUOUS CALIBRATION. RATHER THAN EMPLOYING A SINGLE REFERENCE TEMPERATURE, THE RADIOMETER IS SWITCHED BETWEEN TWO DIFFERENT REFERENCE SOURCES. THE REFERENCE SWITCH OPERATES AT ONE HALF THE DICKE SWITCH FREQUENCY SO THAT THE TWO REFERENCE TEMPERATURES ARE SEEN ON ALTERNATE OBSERVATIONS OF THE REFERENCE CHANNEL BY THE SYSTEMS. THE RADIOMETER WOULD YIELD OVER 1400 INDEPENDENT DATA POINTS FOR EACH COMPLETE SCAN OF THE EARTH. SUCH A DENSE NET OF OBSERVATIONS OVER THE WORLD'S OCEANS WOULD SIGNIFICANTLY INCREASE THE INFORMATION AVAILABLE, PARTICULARLY OVER INACCESSIBLE AND CLOUDY AREAS.</p>									
32. PHENOMENA OBSERVED									
MICROWAVE ENERGY EMITTED BY THE OCEAN SURFACE									
33. MEASUREMENT RANGE									
RADIANT TEMPERATURE FROM 80 TO 120 DEGREES KELVIN									
34. PRECISION AND ACCURACY									
RADIANT TEMPERATURE: 1 DEG K ABSOLUTE; 0.1 DEG K RELATIVE									

35. SPECTRAL RANGE	2.7	36. SPECTRAL RESOLUTION	137. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH		
25.4	DEG 270 NM BY 270 NM FROM 600 NM ALTITUDE		
39. ANGULAR RESOLUTION 41. SPATIAL RESOLUTION			
25.4	DEG 270 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
		MED	SUN-SYNCH RETROGRADE
46. SPECIAL REQUIREMENTS			
TWO LARGE HORN ANTENNAS			
47. COMPONENTS			
ANTENNA, RADIOMETER			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
39 LB.	1.6 CU FT	54 WATTS	52. PEAK POWER
		54 WATTS	53. MTBF
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. SHIELDING
SENSITIVE			
52. CALIBRATION	53. DATA RECOVERY	54. FREQUENCY OF OBSERVATION	
CONTINUOUS SWITCHING	DELAYED TELEMETRY	OVER OCEAN	
59. TELEMETRY REQUIREMENTS			
EXPERIMENT DATA-1 SAMPLE EVERY 1.5 SECONDS, REFERENCE TEMPERATURE-1 SAMPLE EVERY 3 SECONDS, 6 CHANNELS OF HOUSEKEEPING DATA-1 SAMPLE EVERY SECOND; COMPATIBLE WITH NIMBUS HBRSS.			
62. ADVANTAGES AND LIMITATIONS			
HIGH THERMAL ACCURACY, SPATIAL-RESOLUTION OBTAINED IS LOW.			
63. REFERENCES			
1) EWING, G.C.: PROPOSAL FOR SATELLITE MICROWAVE RADIOMETRY TO SENSE THE SURFACE TEMPERATURE OF THE WORLD OCEANS, WHOI, FEB 68. **2) VECCHIO, R.A.: EMISSION FROM THE ROUGH SEA, AUTONETICS TECHNICAL REPORT T7-2262/060, OCT 9, 1967.			
65. HISTORICAL REMARKS			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
OZONE-CONCENTRATION VERTICAL PROFILE EXPERIMENT		OCVP		E17					
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0005					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
BLAMONT, J.E.		SERVICE D'AERONOMIE		PARIS, FRANC					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
NONE		NA		INACT PROPOSAL					
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
NA		NA		NA		NA		NA	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. STATUS	
SCHARDT, B.		NASA HDOTRS		OSSA/SRN		202-962-0891		INACT	
22. VENDOR		23. LOCATION		24. LEAD TIME		25. DATE		26. LEAD TIME	
				NA					
26. INSTRUMENT TYPE		27. APPLICATION		28. SPACECRAFT		29. PRO			
PHOTOMETER, TWO-CHANNEL SCANNING UV				NIMBUS F					
30. PURPOSE		31. PLAN-ATH		32. NIMBUS F					
<p>PRIMARY - TO DETERMINE THE OZONE DISTRIBUTION AND ITS VARIABILITY AT ALTITUDES GREATER THAN 40 KILOMETERS. TO DETERMINE OZONE CONCENTRATION DIFFERENCES BETWEEN NIGHTTIME AND DAYTIME.***</p> <p>SECONDARY - TO DETERMINE MORE PRECISELY THAN NOW KNOWN THE CAUSE OF THE DAILY VARIATIONS IN OZONE DISTRIBUTION.</p>									
<p>33. PRINCIPLES OF OPERATION</p> <p>A SCANNING PHOTOMETER WILL BE USED TO MEASURE THE ANGULAR DISTRIBUTION OF THE INTENSITY OF THE LIGHT EMITTED BY THE ATMOSPHERE IN FRONT OF THE SATELLITE IN TWO WAVELENGTH REGIONS: 2500 AND 2850 ANGSTROMS. DURING THE NIGHT THE ATMOSPHERE EMITS THE HERZBERG OXYGEN BANDS AT AN ALTITUDE OF 95 KILOMETERS IN THE REGION 2300-3000 ANGSTROMS. THIS SOURCE OF LIGHT CAN BE ABSORBED BY OZONE SINCE THIS EMISSION TAKES PLACE IN THE MAXIMUM OF THE HARTLEY CONTINUUM. THE PHOTOMETER IS PLACED IN ORBIT ABOVE THE EMISSION AND THE OZONE LAYER. IF THE FIELD OF VIEW IS SCANNED WITH A VERTICAL RESOLUTION ON THE ORDER OF 10 MINUTES OF ARC FROM THE HORIZON TO AN ALTITUDE OF 110 KM (OVER 3 DEGREES) OVER A PERIOD OF TWENTY SECONDS, THE INTENSITY OF THE LIGHT ARRIVING FROM A GIVEN ANGLE WILL COME FROM TWO PARTS OF THE OXYGEN LAYER: (1) A PART NEAR THE SATELLITE, WHICH IS NOT USEFUL (2) A PART FAR AWAY FROM THE SATELLITE, WITH RAYS HAVING TRAVERSED THE OZONE LAYER OVER A GIVEN LENGTH. KNOWING THE INTENSITY OF THE INCOMING RADIATION, THE PATH LENGTH, AND THE ABSORPTION COEFFICIENT OF OZONE, THE OZONE CONCENTRATION CAN BE CALCULATED.</p>									
<p>34. PHENOMENA OBSERVED</p> <p>UV RADIATION EMITTED BY ATMOSPHERE</p>									
<p>35. MEASUREMENT RANGE</p>									
<p>36. PRECISION AND ACCURACY</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
2500 TO 2850		0.214 PERCENT			
38. FIELD OF VIEW		39. GROUND SWATH			
5.0 BY 3.0 DEG NA					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
0.17 DEG NA					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
				HIGH	
45. SPECIAL REQUIREMENTS		46. ALTITUDE		47. INCLINATION	
48. COMPONENTS		49. AVERAGE POWER		50. PEAK POWER	
PHOTOMETER USING ASCOP 541 F 08 18 SOLAR BLIND PHOTOMULTIPLIER		51. STANDBY POWER		52. MTBF	
10 LB		53. CU FT		54. WATTS	
55. INTERFERENCE		56. INTERFERENCE		57. SHIELDING	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
CALIBRATION LIGHTS		DELAYED TELEMETRY			
61. TELEMETRY REQUIREMENTS		62. TELEMETRY REQUIREMENTS			
MAIN FRAME 4 ANALOG WORDS (FOR SIGNAL) AND 1 DIGITAL WORD (FOR STATUS) . SUB-COMMUTATOR 2 ANALOG WORDS.					
63. ADVANTAGES AND LIMITATIONS		64. REFERENCES			
		1) BLAMONT, J.E.: PROPOSAL FOR NIMBUS E, DETERMINATION OF THE VERTICAL PROFILE OF OZONE CONCENTRATION ABOVE 40 KM, SERVICE D'AERONOMIE DU C.N.R.S., FEB 68.			
65. HISTORICAL REMARKS		66. DIAGRAMS			



INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME DATE		5. VERSION	
SIMPLIFIED DATA-COLLECTION EXPERIMENT		SDC		B26		11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
CURRY, R. C.		RCA ASTRO-ELECTRONICS		609-448-3400		BROWN, J.		RCA ASTRO-ELECTRONICS	
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		16. COMPLETION DATE	
NA		NA		NA		NA		INACT PROPOSAL	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. VENDOR	
SCHARDT, B. B.		NASA HDOTRS		OSSA/SRN		202-962-0891		23. LOCATION	
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		NA		30 MONTHS		24. DATE	
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
DATA RELAY, I-BAND 400/466-MHZ		PRO		HYDR. ERSP		NIMBUS E			
<p>PRIMARY-TO DEMONSTRATE SYSTEM FEASIBILITY USING ONE-TRACK OF THE EXISTING FIVE-TRACK NIMBUS HIGH-DATA-RATE STORAGE SUBSYSTEM (HDRS) TAPE RECORDER FOR ON-BOARD STORAGE OF DATA TELETERRED FROM EXISTING HYDROLOGY STATIONS WITHIN THE CONTINENTAL UNITED STATES.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THIS SATELLITE DATA COLLECTION SYSTEM WOULD, INITIALLY, PROVIDE TWICE A DAY CONTACT WITH TEN REMOTE HYDROLOGIC SENSOR STATIONS. THE SYSTEM CAN BE EXPANDED TO HANDLE UP TO 250 SENSOR STATIONS PER ORBIT. OPERATIONALLY, THE SYSTEM COULD ACCOMMODATE 10,000 SENSOR STATIONS IN THE U.S. THE DATA WILL BE RECORDED ON ONE TRACK OF FIVE-TRACK HDRS TAPE RECORDER ON-BOARD THE NIMBUS SPACECRAFT. TO MINIMIZE THE DEVELOPMENT COSTS ASSOCIATED WITH THE EXPERIMENT, A MEMORY WILL BE USED ON THE SPACECRAFT TO STORE THE ADDRESSES AND INTERROGATION TIMES OF THE SENSOR STATIONS THAT ARE TO BE INTERROGATED DURING THE NEXT ORBIT. EACH SENSOR STATION WILL BE INDIVIDUALLY INTERROGATED BY TRANSMITTING ITS UNIQUE ADDRESS FROM A 5-WATT SPACECRAFT TRANSMITTER VIA AN OMNI-DIRECTIONAL ANTENNA. ASSUMING THAT DATA FROM TEN DIFFERENT SENSORS IS TRANSMITTED, THE TOTAL TIME FROM SPACECRAFT INTERROGATION OF THE SENSOR PLATFORM TO THE COMPLETION OF ITS REPLY IS 0.11 SECONDS. THUS THE SPACECRAFT CAN INTERROGATE 9 PLATFORMS EVERY SECOND, OR ABOUT 3,300 PLATFORMS DURING A NORMAL CONTINENTAL UNITED STATES CONTACT.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>DATA READOUT OF SURFACE HYDROLOGIC SENSORS</p>									
<p>33. MEASUREMENT RANGE</p> <p>INTERROGATION AND REPLY FROM 10000 STATIONS IN THE UNITED STATES</p>									
<p>34. PRECISION AND ACCURACY</p> <p>S/C RECEIVER NOISE FIGURE = 4 DB; DATA ACCURACY TO 1 PERCENT</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
NA		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		HIGH	
45. SPECIAL REQUIREMENTS		46. SPECIAL REQUIREMENTS		47. COMPONENTS	
REQUIRES ONE TRACK OF THE NIMBUS HDRS TAPE RECORDER		REQUIRES ONE TRACK OF THE NIMBUS HDRS TAPE RECORDER		TRANSMITTER, RECEIVER, SENSOR INTERROGATION ADDRESS MEMORY	
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
10 LB		0.23 CU FT		1 WATT	
51. INTERFERENCE		52. INTERFERENCE		53. MTBF	
NONE		NONE		25 WATTS 12 MON	
54. INTERFERENCE		55. INTERFERENCE		56. SHIELDING	
NONE		NONE		NONE	
57. CALIBRATION		58. DATA RECOVERY		59. FREQUENCY OF OBSERVATION	
NONE		DELATED TELEMETRY		TWICE/DAY/STATION	
60. TELEMETRY REQUIREMENTS		61. ADVANTAGES AND LIMITATIONS		62. REFERENCES	
150 BITS PER GROUND STATION TRANSMITTED TO NIMBUS ON A 460 MHZ (I-BAND) CARRIER FREQUENCY. INTERROGATION CARRIER FREQUENCY IS 400 MHZ. DATA TRANSMITTED TO CDA STATION AT 32 TO 1 SPEED-UP.		WORLD WIDE COVERAGE FOR 535,000 SENSORS COULD BE HANDLED BY HALF THE CAPACITY OF ONE TRACK OF THE 5 TRACK HDRS RECORDER.		1) PROPOSAL FOR NIMBUS E SIMPLIFIED DATA COLLECTION EXPERIMENT, RCA/PRINCETON, FEB 68.	
63. HISTORICAL REMARKS					
64. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. DATE		5. VERSION	
SIMPLIFIED TELEVISION CAMERA (TITLE CONT.)		SIMTV		P24		11/10/69		0005	
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. CO-INVESTIGATOR		10. ORGANIZATION	
NICHOLS, GRADY B.		SOUTHERN RESEARCH INST		205-323-6592-X361		HORN, JAMES F.		SOUTHERN RESEARCH INST	
12. CONTRACT NUMBER		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. DATE		16. STATUS	
NA		NA		NA		NA		INACT PROPOSAL	
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. VENDOR	
SCHARDT, B.		NASA HQ/TS		OSSA/SRN		202-962-0891		23. LOCATION	
SOUTHERN RESEARCH INST		BIRMINGHAM, ALABAMA		NA		30 MONTHS		24. LEAD TIME	
26. INSTRUMENT TYPE		27. DATE		28. APPLICATION		29. SPACECRAFT		30. PURPOSE	
IMAGER, LINEAR-ARRAY SCANNING TELEVISION		11/71		PRO		NIMBUS E		PRIMARY - TO PROVE THE FEASIBILITY OF UTILIZING THE ORBITAL NOTION OF A SATELLITE AS THE VERTICAL SCANNING FUNCTION OF A SIMPLE TELEVISION SYSTEM WHICH UTILIZES PHOTODIODES AS THE SENSOR RATHER THAN A CONVENTIONAL VIDICON TUBE.	
31. PRINCIPLES OF OPERATION									
<p>THE THREE-AXIS STABILIZED SPACECRAFT PROVIDES A PLATFORM FOR THE CAMERA SYSTEM. A LINEAR ARRAY OF PHOTODIODES DEPOSITED ON A SINGLE SUBSTRATE, TOGETHER WITH CAMERA OPTICS, SERVES AS THE SENSOR MECHANISM FOR THE CAMERA SYSTEM. EACH OF THE 500 PHOTODIODES IS SAMPLED ON ONE SECOND INTERVALS AND RESET FOR THE NEXT INTEGRATION PERIOD. THE LIGHT FROM A PORTION OF THE IMAGE OF THE CLOUD COVER FALLS ON EACH PHOTODIODE FOR A PERIOD OF ONE SECOND, DURING WHICH TIME THE SPACECRAFT MOVES A SURFACE DISTANCE OF SIX KILOMETERS. THIS PERIOD IS MADE TO COINCIDE WITH THE HORIZONTAL RESOLUTION OF THE 500 LINE TELEVISION SYSTEM DETERMINED BY 500 PHOTODIODES FOR AN EARTH COVERAGE OF 3000 KM. THE DATA FROM EACH PHOTODIODE IS MULTIPLIED INTO AN ANALOG-TO-DIGITAL CONVERTER AND SUBSEQUENTLY INTO A DIGITAL RECORDER, PRIOR TO MAGNETIC TAPE RECORDING. THE SPACECRAFT IS INTERROGATED BY A GROUND STATION WHERE A COMPLETE ONE-ORBIT PHOTOGRAPH CAN BE REPRODUCED. NOTE: COMPATIBILITY WITH APT EQUIPMENT ALLOWS REAL-TIME TRANSMISSION CAPABILITY.</p>									
32. PHENOMENA OBSERVED									
WORLD WIDE CLOUD COVER									
33. MEASUREMENT RANGE									
IF DIGITIZED, THE VIDEO SIGNAL WILL PROVIDE 32 LEVELS OF GRAY									
34. PRECISION AND ACCURACY									
IF DIGITIZED, THE VIDEO SIGNAL WILL PROVIDE 32 LEVELS OF GRAY									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
0.4 TO 0.7 MICRONS		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
110. BY 0.3 DEG		3000 KM WIDTH FROM 1112 KM ALTITUDE			
40. ANGULAR RESOLUTION <sup>1</sup> SPATIAL RESOLUTION					
0.31 DEG 6 KM FROM 1112 KM ORBITAL ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		45. INCLINATION	
		MED		SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
TELEVISION CAMERA, ELECTRONICS, POWER SUPPLY ADAPTOR					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
6 LB		.09 CU FT		3 WATTS	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
NONE		NONE		NONE	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		DELAYED TELEMETRY		CONTINUOUS	
62. TELEMETRY REQUIREMENTS					
3.0 KILOBITS/SEC DIGITAL, OR 500 SAMPLES/SEC ANALOG					
63. ADVANTAGES AND LIMITATIONS					
THE DATA FROM THIS CAMERA SYSTEM WILL BE COMPATIBLE WITH EXISTING APT EQUIPMENT					
64. REFERENCES					
1) A SIMPLIFIED TELEVISION CAMERA FOR THE NIMBUS E SPACE FLIGHT, SOUTHERN RESEARCH INSTITUTE, FEB 68.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
SOLAR-CONSTANT EXPERIMENT	SOLCON E19								
(TITLE CONT.)	4. RESUME DATE	5. VERSION							
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
MCKEOWN, D.	PARADAY LABS	714-459-2412							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
BOWYER, J.M.	KANSAS STATE UNIVERSITY	913-532-6011							
12. CONTRACT NUMBER	13. FLASH INDEX NUMBER	14. START DATE	15. COMPLETION DATE	16. STATUS					
NA	NA	NA	NA	INACT PROPOSAL					
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B.	NASA HDOTRS	OSSA/SRN	202-962-0891						
22. VENDOR	23. LOCATION	24. DATE	25. LEAD TIME						
		NA							
26. INSTRUMENT TYPE	27. SEMINAR								
HELIOMETER, HIGH-SENSITIVITY QUARTZ-CRYSTAL DIGITAL	PRO								
28. APPLICATION	29. SPACECRAFT								
NET, ATM-PHYS, ASTR	NIMBUS R								
30. PURPOSE									
PRIMARY-TO MEASURE IN SPACE THE ABSOLUTE VALUE OF THE SOLAR CONSTANT FREE OF ATMOSPHERIC ATTENUATION WITHIN 0.04 PERCENT. THESE DATA WILL PROVIDE A RECORD TO CORRELATE WITH WEATHER CYCLES, CHANGES IN ATMOSPHERIC DENSITY, AND SOLAR ACTIVITY.*** SECONDARY-TO MEASURE SHORT-TERM FLUCTUATIONS OF THE SOLAR CONSTANT TO A PRECISION OF 0.01 PERCENT.									
31. PRINCIPLES OF OPERATION									
A HELIOMETER (ACTUALLY A PYRHELIOMETER) WILL BE USED TO MEASURE THE ABSOLUTE VALUE OF THE SOLAR CONSTANT. TWO Y-CUT GOLD-PLATED QUARTZ CRYSTALS WILL BE EMPLOYED. ONE IS OVER-PLATED WITH BEN-ZENE BLACK AND EXPOSED TO THE SOLAR RADIATION, AND THE OTHER IS ENCLOSED IN A THERMALLY STABILIZED CAVITY. THE CRYSTALS ARE INCORPORATED INTO OSCILLATOR CIRCUITS SUCH THAT THE SIGNAL OUTPUT FREQUENCY IS THE BEAT FREQUENCY OF THE TWO CRYSTALS. IN OPERATION, THE CRYSTAL LOCATED BEHIND A SHUTTER WOULD BE POINTED DIRECTLY TOWARD THE SUN WITH THE SHUTTER OPEN. UNDER THESE CIRCUMSTANCES, THE CRYSTAL WOULD REACH A STEADY-STATE EQUILIBRIUM TEMPERATURE. TO PROVIDE CALIBRATION, THE SHUTTER WOULD PERIODICALLY MOVE A PLANE MIRROR IN FRONT OF THE HELIOMETER, DIRECTING ITS VIEW TOWARD SPACE. ELECTRICAL POWER WOULD THEN BE DISSIPATED IN THE GOLD PLATING ON THE CRYSTAL. THIS DISSIPATED POWER IS A MEASURE OF THE SOLAR CONSTANT. MEASUREMENTS OF SHORT-TERM FLUCTUATIONS WOULD BE MADE WITH THE SECOND QUARTZ-CRYSTAL HELIOMETER WITHOUT THE USE OF A SHUTTER. THE CRYSTAL WOULD BE POINTED DIRECTLY TOWARD THE SUN. FLUCTUATIONS IN THE CALIBRATION POWER OF THE HELIOMETER WOULD REFLECT SHORT-TERM FLUCTUATIONS IN SOLAR RADIATION.									
32. PHENOMENA OBSERVED									
TOTAL SOLAR POWER PASSING THROUGH THE INSTRUMENT APERTURE									
33. MEASUREMENT RANGE									
DYNAMIC RANGE = 0.00001 TO 1.0 WATTS PER SQUARE CENTIMETER									
34. PRECISION AND ACCURACY									
ABSOLUTE VALUE=0.04 PERCENT; SHORT-TERM FLUCTUATIONS=0.01 PERCENT									

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
NA	NA	
38. FIELD OF VIEW	39. GROUND SWATH	
NA	NA	
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
NA	NA	
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
NA	NA	MED
45. INCLINATION	SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS		
MUST BE POINTED AT SUN		
47. COMPONENTS		
TWO HELIOMETERS: 4 Y-CUT CRYSTALS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
5 LB	0.25 CU FT	3 WATTS
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
57. SHIELDING	58. SHIELDING	
NONE		
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
CONTINUOUS	DELAYED TELEMETRY	DAYSIDE OF ORBIT
62. TELEMETRY REQUIREMENTS		
RAW TELEMETRY DATA WILL CONSIST OF TIME, FREQUENCY, AND CALIBRATION POWER FROM THE TWO HELIOMETERS ACQUIRED AT THE RATE OF 25 BITS PER SECOND.		
63. ADVANTAGES AND LIMITATIONS		
IMPROVED ACCURACY, WIDE DYNAMIC RANGE, AND DIGITAL OUTPUT		
64. REFERENCES		
1) MCKEOWN, D. AND BOWYER, J.: PROPOSAL TO MEASURE THE SOLAR CONSTANT - ABSOLUTE VALUE AND SHORT TERM FLUCTUATION, PARADAY LABS, FEB 68.***2) BRANDENBERG, W., CLAUSEN, O., ET AL, JOUR OPT SOC AMER, V. 56, NO. 80 (1966).***3) THEAKARA, N.P.: THE SOLAR CONSTANT AND SPECTRAL DISTRIBUTION OF SOLAR RADIANT FLUX, SOLAR ENERGY, VOL. 9, NO. 1-7 (1965).		
65. HISTORICAL REMARKS		
66. DIAGRAMS		



INSTRUMENT RESUME											
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS											
1. TITLE		2. ACRONYM		3. EXP NO							
SOLAR X-RAY EMISSION EXPERIMENT		SOLXEM		E08							
(TITLE CONT.)		4. RESUME DATE		5. VERSION							
		11/10/69		0004							
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE							
WALKER, A. B. C. JR.		AEROSPACE CORPORATION									
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE							
12. CONTRACT TYPE		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START DATE		17. STATUS			
NA		NA		NA		NA		INACT PROPOSAL			
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE					
SCHARDT, B.		NASA HDOTRS		OSSA/SRN		202-962-0891					
22. VENDOR		23. LOCATION		24. PROJECT NUMBER		25. LEAD TIME					
AEROSPACE CORPORATION		LOS ANGELES, CALIFORNIA		NA							
26. INSTRUMENT TYPE		27. SECURITY		28. SPACECRAFT		29. PURPOSE					
SPECTROMETER, 1 ROCKING AND 1 SCANNING BRAGG CRYSTAL X-RAY		PRO		NIMBUS E							
30. PURPOSE		31. PRINCIPLES OF OPERATION		32. PHENOMENA OBSERVED		33. MEASUREMENT RANGE					
PRIMARY-TO OBSERVE THE SOLAR X-RAY SPECTRUM BETWEEN 1-25A WITH SUFFICIENT SPECTRAL AND SPATIAL RESOLUTION TO CONSTRUCT TIME HISTORIES AND SPATIAL MAPS DURING X-RAY FLARES AND X-RAY EMISSION ASSOCIATED WITH PLAGE REGIONS OF SUN *** SECONDARY - TO DETERMINE THE ATMOSPHERIC DENSITY BETWEEN 60 AND 250 KM BY OBSERVING THE EXTINCTION OF X-RAY LINES BY THE ATMOSPHERE.		IN ORDER TO STUDY THE EMISSION LINE PROFILES OF X-RAY EMISSION LINES ACROSS THE SOLAR DISK A NUMBER OF BRAGG CRYSTAL SPECTROMETERS WILL BE USED. IF AN EMISSION LINE PROFILE HAS A DISTINCT STRUCTURE ACROSS THE SOLAR DISK (DUE TO SEVERAL DISCRETE SOURCES) AND BEYOND THE LIMB, THE RESPONSE OF THE INSTRUMENT AS IT SCANS WILL REFLECT THIS STRUCTURE. THE ANGULAR RESOLUTION WILL DEPEND ON THE NATURAL LINE WIDTH OF THE CRYSTAL AND THE FREQUENCY WITH WHICH THE SPECTROMETER OUTPUT IS SAMPLED. IN MOST CASES THE SAMPLING RATE AND CRYSTAL LINE WIDTH WILL LIMIT THE RESOLUTION TO A FEW MINUTES. POINTING ERRORS WILL BE NEGLIGIBLE WITH RESPECT TO THIS RESOLUTION. IF THERE IS A SECOND STRONG EMISSION LINE WITH A BRAGG ANGLE WITHIN ONE DEGREE THEN THE UNFOLDING OF THE ANGULAR DISTRIBUTION OF EACH LINE WILL BE COMPLICATED BUT WILL NOT BE IMPOSSIBLE. IN ADDITION TO THE ROCKING CRYSTAL SPECTROMETERS, A KAP SPECTROMETER (8 TO 25 A) WILL SCAN THE ENTIRE REGION IN ORDER TO PROVIDE AN OVERALL MONITOR OF THE TOTAL ENERGY IN THIS SPECTRAL REGION, TO AID IN THE INTERPRETATION OF THE DATA FROM THE ROCKING CRYSTAL SPECTROMETERS, AND TO STUDY WITH LESSER TIME AND SPATIAL RESOLUTION THOSE LINES NOT SELECTED FOR DETAILED STUDY.		X-RAY EMISSION FROM THE SUN IN THE 1 TO 25 ANGSTROM REGION		34. PRECISION AND ACCURACY					
35. DYNAMIC RANGE = 30,000		36. PRECISION AND ACCURACY									

35. SPECTRAL RANGE	1. TO 25. A	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
38. FIELD OF VIEW	39. GROUND SWATH		
NA	NA		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION		
0.05 DEG ABOUT 80,000 MILES ON THE SOLAR DISK			
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE	45. INCLINATION
46. SPECIAL REQUIREMENTS	EARTH-ORIENTED STABILIZED PLATFORM; USES SOLAR POINTER		
47. COMPONENTS			
48. WEIGHT	49. VOLUME	50. AVERAGE POWER	51. STANDBY POWER
26 LB		7 WATTS	8 WATTS
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE	57. INTERFERENCE
NONE	SENSITIVE SENSITIVE SENSITIVE 0-40 DEG: 0-1 GAUSS		
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION	
PE 55 X-RAY SOURCE	DELAIED TELEMETRY	DAYSIDE OF ORBIT	
62. TELEMETRY REQUIREMENTS	300 BPS FOR DATA AND HOUSEKEEPING		
63. ADVANTAGES AND LIMITATIONS	COMBINES TECHNIQUES OF BRAGG DIFFRACTION WITH GRAZING INCIDENCE OPTICS ALLOWING MONITORING OF A NUMBER OF SOLAR X-RAY LINES		
64. REFERENCES	1) WALKER, A.B.C., JR.: SOLAR X-RAY SPECTRUM BELOW 25 ANGSTROMS, AEROSPACE CORPORATION, FEB 68.***2) NEUPERT, ET AL: ASTROPHYS. J. LETTERS, 149, 273 (1967).		
65. HISTORICAL REMARKS			
66. DIAGRAMS			

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
TRACKING AND DATA RELAY EXPERIMENT		TOR		E28					
(TITLE CONT.)		4. RESUME DATE		5. VERSION					
		11/10/69		0006					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE					
PICKARD, R. H.		GODDARD SPACE FLT CENTER		301-982-6682					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
HEPPERNAN, PAUL		GODDARD SPACE FLT CENTER							
12. CONTRACT		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. STATUS			
PROPOSAL		16. COMPLETION DATE		17. DATE		18. PROPOSAL			
19. AGENCY		20. PGM OFFICE		21. TELEPHONE		22. LEAD TIME			
SCHMIDT, B.		NASA HQ/OTRS		OSSA/SAN		202-962-0891			
23. LOCATION		24. DATE		25. LEAD TIME		26. INSTRUMENT TYPE			
GODDARD SPACE FLT CENTER GREENBELT, MARYLAND									
27. SECURITY		28. APPLICATION		29. SPACECRAFT		30. PURPOSE			
PRO		NIMBUS E							
<p>PRIMARY-TO DEFINE AND RESOLVE THE TECHNOLOGICAL PROBLEMS IMPOSED BY A TWO-WAY REAL TIME DATA RELAY LINK FROM THE NIMBUS SPACECRAFT THROUGH THE ATS SATELLITE TO A GROUND BASED DATA ACQUISITION FACILITY.*** SECONDARY-TO DEMONSTRATE THE TECHNOLOGICAL UTILITY OF A COMMAND LINK AND OF TWO-WAY DATA TRANSMISSION AT S-BAND OVER APPROXIMATELY 70% OF THE NIMBUS ORBIT.</p> <p>THE ELEMENTS OF THE EXPERIMENT ARE: (1) AN ATS DATA ACQUISITION FACILITY (DAF), (2) THE ATS-F SYNCHRONOUS SATELLITE OPERATING AS A REPEATER/RELAY, AND (3) A NIMBUS-E SATELLITE WITH THE FOLLOWING EQUIPMENTS: ANTENNA WITH CONTROL AND DRIVE SYSTEM, GARR TRANSPONDER, NIMBUS-ATS DATA MULTIPLEXER, AND TWT POWER SIMPLIFIERS. THE DATA MULTIPLEXER RECEIVES SIGNALS FROM THE ONBOARD EXPERIMENTS, SENSORS, TELEMETRY DEVICES, ETC. THE DATA MULTIPLEXER TRANSLATES THE SEPARATE INPUT SIGNALS IN FREQUENCY ACCORDING TO A PRESCRIBED FREQUENCY-DIVISION MULTIPLEX (FDM) SCHEME FOR PHASE MODULATION ONTO AN RF CARRIER. THE MODULATED SIGNAL IS FURTHER TRANSLATED IN FREQUENCY TO 2253 MHZ BY THE UP-CONVERTER AND THEN BROUGHT TO AN OUTPUT POWER LEVEL OF ABOUT TEN WATTS BY THE TWT AMPLIFIER. THE TWT FEEDS THE DIRECTIONAL S-BAND ANTENNA. THE SIGNAL TRANSMITTED BY NIMBUS WILL BE RECEIVED AT THE ATS BY THE S-BAND RECEIVER. THE RECEIVED SIGNAL WILL BE TRANSLATED TO AN INTERMEDIATE FREQUENCY, DOWN-CONVERTED BY 450 MHZ, AMPLIFIED TO A POWER LEVEL OF TEN WATTS, AND FED TO AN EARTH-COVERAGE S-BAND ANTENNA FOR TRANSMISSION TO THE DAF.</p>									
32. PHENOMENA OBSERVED									
DATA FROM ONBOARD EXPERIMENTS, SENSORS, TELEMETRY SYSTEMS, ETC.									
33. MEASUREMENT RANGE									
S-BAND									
34. PRECISION AND ACCURACY									

36. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
2.253		NA		NA	
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
1.0 DEG		0.17 DEG/SEC MED		45. INCLINATION	
46. SPECIAL REQUIREMENTS					
47. COMPONENTS					
TRANSPONDER, POWER AMPLIFIER, MULTIPLEXER, ANTENNA SYSTEM					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
48 LB		1.2 CU FT		44 WATTS	
51. INTERFERENCE		52. INTERFERENCE		53. INTERFERENCE	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
57. INTERFERENCE		58. SHIELDING		59. SHIELDING	
SOURCE/SEN		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
62. TELEMETRY REQUIREMENTS		REALTIME TELEMETRY		AS NEEDED	
63. ADVANTAGES AND LIMITATIONS					
THE EXPERIMENT PROVIDES FOR THE DIRECT RELAY OF NIMBUS E DATA, HENCE DEPENDENCE ON THE RECORDERS CAN BE LESSENED.					
64. REFERENCES					
1) COTE, C., ET AL: A PROPOSAL FOR A TECHNOLOGY EXPERIMENT - NIMBUS E DATA RELAY LINK THROUGH ATS-F, GSFC, MAR 68.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO		4. RESUME		5. VERSION	
VISIBLE-RADIATION POLARIZATION EXPERIMENT		VRP		E20					
(TITLE CONT.)		4. DATE		5. DATE					
6. PRINCIPAL INVESTIGATOR		7. ORGANIZATION		8. TELEPHONE		9. DATE		0005	
SEKERA, DR. Z		UNIV CALIFORNIA, L.A.		213-825-4134					
9. CO-INVESTIGATOR		10. ORGANIZATION		11. TELEPHONE					
HARIHARAN, DR. T.A.		UNIV CALIFORNIA, L.A.		213-825-4445					
12. CONTRACT		13. CONTRACT NUMBER		14. FLASH INDEX NUMBER		15. START		16. STATUS	
NA		NA		NA		INACT PROPOSAL			
18. MONITOR		19. AGENCY		20. PGM OFFICE		21. TELEPHONE			
SCHARDT, B.		NASA HQTRS		OSSA/SRN		202-962-0891			
22. VENDOR		23. LOCATION		24. FLIGHT		25. LEAD TIME		26. MONTHS	
				NA		36 MONTHS			
26. INSTRUMENT TYPE		27. SCORING		28. APPLICATION		29. SPACECRAFT		30. PRO	
POLARIMETER, ELECTROMECHANICAL 4-CHANNEL PHOTOMULTIPLIER									
31. PURPOSE		32. PURPOSE		33. PURPOSE		34. PURPOSE		35. PURPOSE	
NET. ATM-PHYS		NIMBUS B							
31. PRINCIPLES OF OPERATION									
<p>THE POLARIMETER IS DESIGNED TO MEASURE THREE OF THE FOUR STOKES PARAMETERS I, Q, AND U OF THE EMERGENT RADIATION FLUX FROM THE EARTH'S SURFACE BY COMPARING POLARIZED BEAMS WITH UNPOLARIZED BEAMS. COMPARISON IS ACCOMPLISHED BY AN ELECTROMECHANICALLY DRIVEN BEAM SELECTOR WHEEL WHICH IS PLACED IN THE FOCAL PLANE OF THE THREE COLLIMATING LENSES. MEASUREMENTS WILL BE MADE IN FOUR SELECTED SPECTRAL REGIONS, 3800, 4400, 5000, AND 5800 Å, USING APPROPRIATE FILTERS. ONE SET OF STOKES PARAMETERS IN EACH OF THE 4 SPECTRAL BANDS WILL BE OBTAINED EACH SECOND. PROVISION WILL BE MADE FOR AN ADEQUATE DYNAMIC RANGE BY BOTH OPTICAL AND ELECTRONIC MEANS. A SINGLE PHOTOMULTIPLIER TUBE WILL BE USED AS THE DETECTOR. INFLIGHT CALIBRATION WILL BE ACCOMPLISHED BY DIRECT VIEWING OF THE SUN THROUGH A FILTER SEVERAL TIMES DURING THE MISSION AND BY A 12 WATT TUNGSTEN-IODINE LAMP PRECEDING AND FOLLOWING EACH TARGET OBSERVATION. THE INSTRUMENT WILL TRACK A TARGET ON THE EARTH SURFACE AND A SCAN MECHANISM WILL TAKE INTO ACCOUNT THE EFFECTS OF ORBITAL INCLINATION, PRECISION ADJUSTMENTS, ECCENTRICITY, PERIOD, TARGET LATITUDE AND HEIGHT, AND THE EARTH'S OBLATENESS. A MINIMUM OF 100 SCANS AT 6 MINUTES PER SCAN WILL BE MADE.</p>									
32. PHENOMENA OBSERVED									
INTENSITY AND POLARIZATION OF VISIBLE LIGHT FROM THE ATMOSPHERE									
33. MEASUREMENT RANGE									
DYNAMIC RANGE = 0.00082 TO 0.013 WATTS/SQ CM/MICRON/STERADIAN									
34. PRECISION AND ACCURACY									
POLARIZATION TO WITHIN 3 PERCENT									

36. SPECTRAL RANGE		37. SPECTRAL RESOLUTION		38. TIME CONSTANT	
3800 TO 5800 Å		7.5 PERCENT			
39. FIELD OF VIEW		40. GROUND SWATH			
3. DEG 30 NM DIAM CIRCLE FROM 600 NM ALTITUDE					
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
3. DEG 30 NM FROM 600 NM ALTITUDE					
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
0.5 DEG		2. DRG/SEC		45. INCLINATION	
46. SPECIAL REQUIREMENTS		POSIGRADE			
47. COMPONENTS					
POLARIMETER, SCANNING MECHANISM, CALIBRATORS, ELECTRONICS					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
45 LB		2.0 CU FT		51. STANDBY POWER	
52. INTERFERENCE		53. INTERFERENCE		54. INTERFERENCE	
55. INTERFERENCE		56. INTERFERENCE		57. INTERFERENCE	
58. CALIBRATION		59. DATA RECOVERY		60. FREQUENCY OF OBSERVATION	
SEE ITEM 31					
62. TELEMETRY REQUIREMENTS					
187 BITS PER SECOND TOTAL					
63. ADVANTAGES AND LIMITATIONS					
AEROSOL CONTENT DATA WILL BE USEFUL IN INTERPRETATION OF IR RADIOMETRIC DATA: MOVING PARTS					
64. REFERENCES					
1) SEKERA, Z. AND HARIHARAN, T.: PROPOSAL FOR VISIBLE RADIATION POLARIZATION MEASUREMENTS FROM UNMANNED SPACECRAFT, UCLA, JAN 68.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE		2. ACRONYM		3. EXP NO					
WIDE-BAND REAL-TIME DATA-TRANSMISSION EXPERIMENT (TITLE CONT.)		DATAN 829							
4. RESUME DATE		5. VERSION		6. DATE					
11/10/69 0005									
8. PRINCIPAL INVESTIGATOR		9. TELEPHONE		10. TELEPHONE					
KIESLING, J.		RCA ASTRO-ELECTRONICS							
9. CO-INVESTIGATOR		10. ORGANIZATION		11. STATUS					
BAUMUNK, J.		RCA ASTRO-ELECTRONICS		INACT PROPOSAL					
12. CONTRACT NUMBER		13. FLASH INDEX NUMBER		14. DATE					
NA		NA							
18. MONITOR		19. AGENCY		20. PGM OFFICE					
SCARDT, B. R.		NASA HDOTRS		OSSA/SRN 207-962-0891					
21. VENDOR		23. LOCATION		24. DATE					
RCA ASTRO-ELECTRONICS		PRINCETON, NEW JERSEY		NA					
26. INSTRUMENT TYPE		27. SECURITY		28. APPLICATION					
DATA RELAY, S-BAND SELF-FOCUSING PHASED-ARRAY TRANSPONDER		PRO		29. SPACECRAFT					
MET. ERSF		NIMBUS R							
30. PURPOSE									
<p>PRIMARY-TO DEMONSTRATE THE IMPLEMENTATION OF WIDE-BAND AND NARROW-BAND DATA READOUT TO SMALL GROUND STATIONS.***SECONDARY-TO SOLVE VARIOUS OPERATIONAL PROBLEMS INCLUDING ACQUISITION AND TRACKING NETWORK DISCIPLINE REQUIRED IN MULTI-BEAM OPERATION, AND NEW ENERGY BALANCE PROCEDURES.</p>									
<p>31. PRINCIPLES OF OPERATION</p> <p>THE SATELLITE SYSTEM WILL CONSIST OF A SOLID-STATE SELF-FOCUSING, PHASE-CONJUGATED RETRODIRECTIVE ANTENNA WHICH WILL AUTOMATICALLY POINT ITS BEAM (OR BEAMS) IN THE DIRECTION OF A DISTANT GROUND STATION WHICH IS RADIATING A CONTINUOUS WAVE PILOT OF THE CORRECT FREQUENCY. DURING THE ALLOWABLE ON-PERIOD, THE ARRAY SENSES ANY GROUND-STATION PILOT TRANSMISSION AND FORMS A TRANSIT BEAM IN THE DIRECTION OF THE PILOT. THE BEAM TRACKS THE PILOT INDEPENDENT OF ANY SPACECRAFT MOTION. THE ARRAY ALSO HAS THE CAPABILITY OF BEAMING TO TWO OR MORE GROUND STATIONS. THE TRANSMITTER WOULD TURN OFF EITHER AT THE END OF THE COMMAND ON-PERIOD OR WHEN THE PILOT SIGNAL ENDS. ON THE GROUND, THE RECEIVED S-BAND (2200 MHZ WITH A 20 MHZ BANDWIDTH) SIGNAL IS DETECTED, DEMULTIPLEXED IF NECESSARY, AND FED TO SIGNAL PROCESSORS FOR DATA RECORDING OR PRINTOUT. THE GROUND STATION ANTENNA WOULD BE APPROXIMATELY 10 TO 15 FEET IN DIAMETER. OPERATION OF THIS GROUND STATION WITH THE SATELLITE PHASED ARRAY WILL DEMONSTRATE THE FEASIBILITY OF THE OVERALL SYSTEM, IDENTIFY NECESSARY OPERATIONAL PROCEDURES AND PROBLEMS, AND PROVIDE FIRM BASIS FOR THE DESIGN AND PRODUCTION OF LOW-COST PORTABLE OPERATIONAL TERMINALS.</p>									
<p>32. PHENOMENA OBSERVED</p> <p>HAVE PILOT FOR GROUND STATION ACQUISITION AND TRACKING</p>									
<p>33. MEASUREMENT RANGE</p>									
<p>34. PRECISION AND ACCURACY</p>									
<p>SIGNAL TO NOISE RATIO = 40 DB AT LIMITING SLANT RANGE</p>									

35. SPECTRAL RANGE		36. SPECTRAL RESOLUTION		37. TIME CONSTANT	
2-200		GHZ			
38. FIELD OF VIEW		39. GROUND SWATH			
NA		NA			
40. ANGULAR RESOLUTION		41. SPATIAL RESOLUTION			
NA		NA			
42. POINTING ACCURACY		43. POINTING RATE		44. ALTITUDE	
NA		NA		MED	
45. SPECIAL REQUIREMENTS		46. SUN-SYNCH		RETROGRADE	
47. COMPONENTS					
TRANSPONDER, ANTENNA SYSTEM					
48. WEIGHT		49. VOLUME		50. AVERAGE POWER	
				51. STANDBY POWER	
				52. PEAK POWER	
				53. MTBF	
54. INTERFERENCE		55. INTERFERENCE		56. INTERFERENCE	
SOURC/SEN		57. SHIELDING		58. SHIELDING	
59. CALIBRATION		60. DATA RECOVERY		61. FREQUENCY OF OBSERVATION	
		DELAYED TELEMETRY		ON COMMAND	
62. TELEMETRY REQUIREMENTS					
2200 MHZ TRANSPONDER WITH A 20 MHZ BANDWIDTH					
63. ADVANTAGES AND LIMITATIONS					
LOWER COST AND SMALLER S-BAND GROUND STATIONS BECOME FEASIBLE, ANTENNA HAS AUTOMATIC ELECTRONIC STEERING					
64. REFERENCES					
1) KIESLING, H.S. AND BAUMUNK, J.: PROPOSAL FOR WIDE-BAND REAL-TIME DATA TRANSMISSION, RCA ASTRO-ELECTRONICS, FEB 29, 68.					
65. HISTORICAL REMARKS					
66. DIAGRAMS					

INSTRUMENT RESUME									
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS									
1. TITLE	2. ACRONYM	3. EXP NO							
WIND VELOCITY EXPERIMENT (TITLE CONT.)	AVCS	E18A							
4. RESUME DATE	5. VERSION								
11/10/69	0005								
MODIFIED ADVANCED VIDICON CAMERA SYSTEM (AVCS)									
6. PRINCIPAL INVESTIGATOR	7. ORGANIZATION	8. TELEPHONE							
WOODRICK, N.W.	IBM CORP FEDERAL SYS DIV	301-921-6000							
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE							
LEESE, DR. J. A.	IBM CORP FEDERAL SYS DIV	301-921-6000							
12. CONTRACT NO.	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. START DATE	16. COMPLETION DATE	17. STATUS				
NA	NA	NA	NA	NA	INACT PROPOSAL				
18. MONITOR	19. AGENCY	20. PGM OFFICE	21. TELEPHONE						
SCHARDT, B.	NASA HQ/RTS	LOSSA/SRN	202-296-0891						
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME						
		NA	NA						
26. INSTRUMENT TYPE									
IMAGER, 1-INCH MODIFIED AVCS TELEVISION									
27. APPLICATION									
NET, ATM-PHYS									
28. PURPOSE									
PRIMARY-TO MEASURE THE HORIZONTAL AND VERTICAL DISTRIBUTION OF ATMOSPHERIC WIND VELOCITY FROM MEASUREMENTS OF CLOUD VELOCITIES AND CLOUD ALTITUDES. ***SECONDARY-TO EVALUATE THIS DUAL TECHNIQUE AS A METHOD FOR OBTAINING QUANTITATIVE WIND VELOCITY INFORMATION ESPECIALLY OVER REGIONS FOR WHICH SUCH DATA IS SPARSE.									
29. PRINCIPLES OF OPERATION									
THIS EXPERIMENT COMPRISES TWO SENSORS, THE HIGH RESOLUTION ADVANCED VIDICON CAMERA SYSTEM (AVCS), DESCRIBED HERE, AND AN IR CLOUD-TOP TEMPERATURE RADIOMETER, DESCRIBED IN E18B. THE SENSORS ARE CONFIGURED SO THAT AT LEAST 2 (AND AS MANY AS 10) COMPLETELY OVERLAPPING VIDICON IMAGES AND ONE IR SCAN OF THE SAME GEOGRAPHIC AREA WILL BE OBTAINED. THE EXPERIMENT WILL BE ACTIVATED ON THE FOUR ORBITS CORRESPONDING IN TIME TO THE FOUR STANDARD WORLD WEATHER WATCH RADIOSONDE OBSERVATION TIMES. IN THE DAYLIGHT PORTION OF THE SELECTED ORBIT, ONE TO THREE SCENES WILL BE OBSERVED AND A MINIMUM OF THREE PHOTOS OF EACH SCENE WILL BE OBTAINED. FROM A PAIR OF CLOUD PICTURES TAKEN OVER THE SAME GEOGRAPHICAL AREA AND A KNOWN NUMBER OF SECONDS APART, RELATIVE CLOUD MOTIONS WILL BE OBTAINED BY MEANS OF TWO-DIMENSIONAL CORRELATION OF THE TWO PICTURES. THE AVCS CONSISTS OF FOUR PRINCIPAL UNITS--THE OPTICAL SUBSYSTEM, VIDICON CAMERA TUBE, ELECTRONICS SUBSYSTEM, TAPE STORAGE FACILITY. THE OBJECTIVE LENS DIAMETER IS APPROXIMATELY ONE INCH WITH A FOCAL LENGTH OF 3.56 INCHES. A CONTROLLABLE IRIS WITH FIXED STOPS AT F/4, F/5.6, F/8, AND F/16 IS AVAILABLE. THE RESOLUTION IS 800 LINE PAIRS VERTICALLY AND 800/SINE WAVE CYCLES HORIZONTALLY. THE SIGNAL TO NOISE RATIO IS 32 DECIBELS.									
32. PHENOMENA OBSERVED									
VISIBLE RADIANT ENERGY FROM THE EARTH'S SURFACE AND ATMOSPHERE									
33. MEASUREMENT RANGE									
CLOUD VELOCITIES FROM 0 TO 200 MPH; DYNAMIC RANGE=16 GRAY LEVELS									
34. PRECISION AND ACCURACY									
WIND VELOCITY KNOWN TO WITHIN 5 TO 10 KNOTS									

36. SPECTRAL RANGE	38. SPECTRAL RESOLUTION	37. TIME CONSTANT
0.3 TO 0.7 MICRONS NA		
39. FIELD OF VIEW	39. GROUND SWATH	
12. BY 12. DEG 128 BY 128 NM FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.02 DEG 0.25 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	
0.003 DEG	44. ALTITUDE	
	45. INCLINATION	
	SUN-SYNCH RETROGRADE	
46. SPECIAL REQUIREMENTS		
YAW ERRORS SHOULD BE KNOWN TO 0.05 DEGREE		
47. COMPONENTS		
AVCS/MIRROR CYROS TAPE RECORDER COMMAND MEMORY ATTITUDE DATA SYS		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
70 LB	2.8 CU FT	12 WATTS
	51. STANDBY POWER	52. PEAK POWER
	53. MTBF	12 MOH
54. INTERFERENCE	55. INTERFERENCE	56. INTERFERENCE
SENSITIVE		57. SHIELDING
59. CALIBRATION	60. DATA RECOVERY	61. FREQUENCY OF OBSERVATION
GRAY SCALE, POSITION	DELAYED AND REALTIME	3 SETS OF 3 PIC/SEC
62. TELEMETRY REQUIREMENTS		
60 KHZ BANDWIDTH RECORDER REQUIRED FOR VIDICON DATA. FRAME READ READ-OUT TIME IS 6 SECONDS. 1410 BITS OF HOUSEKEEPING DATA PER DATA FRAME.		
63. ADVANTAGES AND LIMITATIONS		
POSSIBLE APPLICATION TO OTHER EXPERIMENTS: SELECTION OF TRACKABLE CLOUD PATTERNS MAY BE DIFFICULT. CRITICAL POINTING ACCURACY		
64. REFERENCES		
1) WOODRICK, N.W.: PROPOSAL FOR A NIMBUS WIND VELOCITY EXPERIMENT, IBM CORP, BETHESDA, MD, FEB 68. ***2) LEESE, J.: DIGITAL CROSS-CORRELATION TECHNIQUE FOR CLOUD VELOCITY DETERMINATION, IBM IRAD TASK, 1967. ***3) WOODRICK, N.: THE DETERMINATION OF WIND VELOCITY FROM EARTH SATELLITE OBSERVATIONS OF CLOUD MOTIONS IBM IRAD TASK, AUG 64.		
65. HISTORICAL REMARKS		
AVCS AND CAR ARE BOTH PARTS OF THE WIND VELOCITY EXPERIMENT		
46. DIAGRAMS		

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ELECTRONICS RESEARCH CENTER CAMBRIDGE, MASSACHUSETTS			
1. TITLE	2. ACRONYM	3. EXP NO	
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(TITLE CONT.)	4. RESUME DATE	5. VERSION	
	11/10/69	0005	
6. CLOUD ALTITUDE RADIOMETER	7. ORGANIZATION	8. TELEPHONE	
WOODRICK, N.W.	IBM CORP FEDERAL SYS DIV	301-921-6000	
9. CO-INVESTIGATOR	10. ORGANIZATION	11. TELEPHONE	
LEESE, DR. J.A.	IBM CORP FEDERAL SYS DIV	301-921-6000	
12. CONTRACT NUMBER	13. CONTRACT NUMBER	14. FLASH INDEX NUMBER	15. STATUS
NA	NA	NA	INACT. PROPOSAL
16. MONITOR	17. AGENCY	18. TGM OFFICE	19. TELEPHONE
SCHARDT, B.	NASA HQ/OTRS	055A/SRN	202-962-0891
22. VENDOR	23. LOCATION	24. FLIGHT DATE	25. LEAD TIME
		NA	
26. INSTRUMENT TYPE	27. APPLICATION	28. SPACECRAFT	29. PRO.
RADIOMETER, INFRARED IMAGE-FORMING PASSIVE			
30. PURPOSE	31. MET. ATM-PHYS	32. NIMBUS E	
PRIMARY-TO MEASURE THE HORIZONTAL AND VERTICAL DISTRIBUTION OF ATMOSPHERIC WIND VELOCITY FROM MEASUREMENTS OF CLOUD VELOCITIES AND CLOUD ALTITUDES.***SECONDARY-TO EVALUATE THIS DUAL TECHNIQUE AS A METHOD FOR OBTAINING QUANTITATIVE WIND VELOCITY INFORMATION, ESPECIALLY OVER REGIONS FOR WHICH SUCH DATA IS SPARSE.			
31. PRINCIPLES OF OPERATION			
THIS EXPERIMENT COMPRISES TWO SENSORS, THE CLOUD ALTITUDE RADIOMETER (CAR), DESCRIBED HERE, AND THE ADVANCED VIDICON CAMERA SYSTEM (AVCS), DESCRIBED IN E18A. THE SENSORS ARE CONFIGURED SO THAT AT LEAST 2 (AND AS MANY AS 10) COMPLETELY OVERLAPPING VIDICON IMAGES AND ONE IR SCAN OF THE SAME GEOGRAPHIC AREA WILL BE OBTAINED. THE EXPERIMENT WILL BE ACTIVATED ON THE FOUR ORBITS CORRESPONDING IN TIME TO THE FOUR STANDARD WORLD WEATHER WATCH RA-DIOSONDE OBSERVATION TIMES. IN THE DAYLIGHT PORTION OF THE SE-LECTED ORBIT, ONE TO THREE SCENES WILL BE OBSERVED AND A MINIMUM OF THREE PHOTOS OF EACH SCENE WILL BE OBTAINED. THE DETERMINATION OF CLOUD ALTITUDE WILL BE ACCOMPLISHED BY MEASURING CLOUD-EMIT-TED RADIATION WITHIN THE APPROPRIATE SPECTRAL INTERVAL USING AN IMAGE FORMING RADIOMETER. THE INSTRUMENT USES A LINEAR MULTI-ELEMENT SENSOR ARRAY ORIENTED PERPENDICULAR TO THE LINE OF FLIGHT. THE RADIOMETER USES THE FORWARD MOTION OF THE SPACECRAFT TO SCAN PARALLEL TO THE LINE OF FLIGHT. TO DETERMINE ABSOLUTE IR RADIATION LEVELS, CLOUD RADIANCE WILL BE COMPARED ONE OR MORE TIMES DURING EACH LINE SCAN WITH A REFERENCE SOURCE OF KNOWN LEVEL (A CHOPPER FLAG WHOSE EMISSIVITY AND TEMPERATURE ARE KNOWN).			
32. PHENOMENA OBSERVED			
INFRARED ENERGY IN THE 10 TO 11 MICRON REGION EMITTED BY CLOUDS			
33. MEASUREMENT RANGE			
TEMPERATURE FROM 190 TO 300 DEGREES KELVIN			
34. PRECISION AND ACCURACY			
CLOUD ALTITUDE WITHIN 2000 TO 3000 FT; TEMPERATURE WITHIN 1 K DEG			

35. SPECTRAL RANGE	36. SPECTRAL RESOLUTION	37. TIME CONSTANT
10. TO 11. MICRONS/NA		
38. FIELD OF VIEW	39. GROUND SWATH	
12. BY 12. DEG 128 BY 128 NM FROM 600 NM ALTITUDE		
40. ANGULAR RESOLUTION	41. SPATIAL RESOLUTION	
0.05 DEG 0.5 NM FROM 600 NM ALTITUDE		
42. POINTING ACCURACY	43. POINTING RATE	44. ALTITUDE
		SUN-SYNCH RETROGRADE
45. SPECIAL REQUIREMENTS		
VAV ERRORS SHOULD BE KNOWN TO 0.05 DEGREE		
46. CO-INVESTIGATOR	47. ORGANIZATION	
RADIOMETER		
48. WEIGHT	49. VOLUME	50. AVERAGE POWER
15 LB.	0.6 CU FT	51. STANDBY POWER
		52. PEAK POWER
		53. MTBF
54. INPUTS	55. INTERFERENCE	56. SHIELDING
57. CALIBRATION	58. DATA RECOVERY	59. FREQUENCY OF OBSERVATION
CHOPPER ONCE/LINESCAN	DELAYED AND REALTIME	3 IMAGES/ORB 4/TV
60. TELEVIEW REQUIREMENTS		
4 ANALOG TELEMETRY SIGNALS REQUIRED DURING NOMINAL 32 SECOND RADIOMETER PICTURE SEQUENCE. TOTAL STORAGE REQUIREMENT FOR EACH SEQUENCE IS 1024 BITS.		
61. ADVANTAGES AND LIMITATIONS		
RADIOMETER COULD BE USED ON A TIME-SHARED BASIS WITH OTHER EXPERIMENTS		
62. REFERENCES		
1) WOODRICK, N.W.: PROPOSAL FOR A NIMBUS WIND VELOCITY EXPERIMENT, IBM CORP, BETHESDA, MD, FEB 68.***2) LEESE, J.: DIGITAL CROSS-CORRELATION TECHNIQUE FOR CLOUD VELOCITY DETERMINATION, IBM IRAD TASK, 1967.***3) WOODRICK, N.: THE DETERMINATION OF WIND VELOCITY FROM EARTH SATELLITE OBSERVATIONS OF CLOUD MOTIONS IBM IRAD TASK, AUG 64.		
63. HISTORICAL REMARKS		
AVCS AND CAR ARE BOTH PARTS OF THE WIND VELOCITY EXPERIMENT		
64. DIAGRAMS		

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